User and maintenance manual for generating sets

Translation of the original instructions

R66C2C

33504041801NE_2_1

EN

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1. Preface

1.1. General recommendations

The information contained in this manual is taken from technical data available at the time of print. In line with our policy of continually improving the quality of our products, this information may be amended without warning.

Read the safety instructions attentively in order to prevent any accident, incident or damage. These instructions must be adhered to constantly.

In order to obtain optimum efficiency and the longest possible service life for the generating sets, maintenance operations must be carried out according to the periods indicated in the attached maintenance tables. If the generating set is used under dusty or unfavourable conditions, some of these periods will be shorter.

Ensure that all adjustments and repairs are carried out by personnel who have received appropriate training. Our agents possess this qualification, and can answer all of your questions. They can also supply you with spare parts and other services and they have qualified staff to carry out preventive and corrective maintenance or even total reconditioning of generating sets.

The left and right sides can be seen from the back of the generating set (the radiator is at the front).

Note: some user and maintenance manuals for engines fitted to generating sets cover control units and include the start-up and shut down procedures for the engines.

As our generating sets are fitted with control units that are specific to the generating sets; only the information that appears in the documentation for the generating set control units should be taken into consideration.

In addition, depending on the manufacturing criteria of the generating sets, some engines may be fitted with specific electrical wiring different to that described in the engine documentation.

1.2. Warnings

In this manual, the warning messages are used as follows:

 DANGER	**Immediate danger.** Indicates an imminent danger which may result in death or serious injury. Failure to follow the instruction shown may pose serious risks to the health and life of those concerned.

 IMPORTANT	**Potential danger.** Indicates a dangerous situation if the warning is not heeded. Failure to follow the instruction indicated may cause minor injuries to those concerned or damage to equipment.

1.3. Pictograms and their meanings

The aim of the pictograms is as follows:

- To draw the attention of the operator or maintenance technician to the potential dangers.
- To explain how to act in the interest of personal safety and to avoid damaging the equipment.

The safety pictograms present on the equipment are explained below.

Warning: danger	Important, Electrical risk	Important, risk of explosion
Important, toxic materials	Important, rotating or moving parts	Important, pressurised fluids
Important, high temperature	Important, corrosive product	Danger: automatic start-up

Figure 1 : Warning pictograms

Entry prohibited to unauthorised persons	Jet washing prohibited

Figure 2 : Pictograms indicating prohibited activities

Reading the manual for the equipment is compulsory	Wearing suitable protective clothing is compulsory	Wearing suitable protective goggles and ear defenders is compulsory
Lifting point required	Forklift required for lifting	Battery charge must be checked
Periodic maintenance compulsory		

Figure 3 : Pictograms indicating compulsory operations

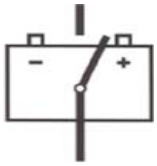
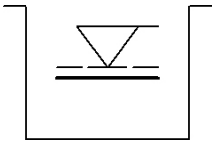
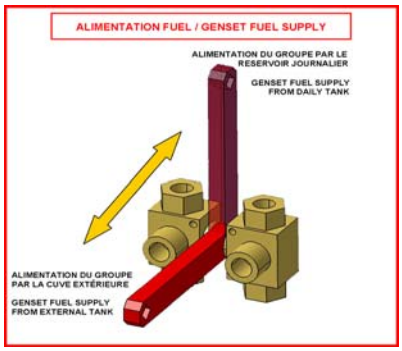
Earth	 Battery isolating switch	External fuel connections
Diesel fuel	Drain the fuel	Inspection flap
Fill the coolant	Drain the coolant	Mains supply connection prohibited before filling with water
Fill the oil	Drain the oil	
 Retention container high level	Drain the retention container	

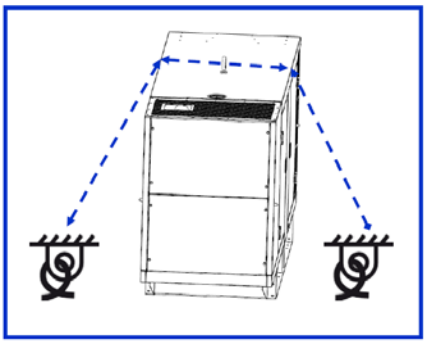
Figure 4 : Information pictograms

Flammable product,
Do not smoke or create sparks or flames

Reading the manual for the equipment is compulsory


ALIMENTATION FUEL / GENSET FUEL SUPPLY
ALIMENTATION DU GROUPE PAR LE RESERVOIR JOURNALIER
GENSET FUEL SUPPLY FROM DAILY TANK
ALIMENTATION DU GROUPE PAR LA CUVE EXTÉRIEURE
GENSET FUEL SUPPLY FROM EXTERNAL TANK

Fuel supply
- Selection valve -



Securing straps routing point

Figure 5 : Specific pictograms

Wearing suitable protective clothing and goggles is compulsory

Rinse any splashes of acid on the skin or in the eyes using clean water.

Consult a doctor immediately.

Wash contaminated clothing with water.

Figure 6 : Pictograms relating to battery operations

1.4. Safety instructions

RETAIN THIS MANUAL

This manual contains important instructions which must be followed when installing or carrying out maintenance on a generating set and batteries.

IMPORTANT - SAFETY ADVICE

If any parts of this manual are not understood, or in case of doubt, contact your nearest agent in order to receive an explanation or demonstration to allow the equipment to be used correctly. The guidelines listed below must always be respected to ensure the safety of personnel and equipment. In addition to this information, it is essential to refer to the local and national regulations applicable according to the jurisdiction.

1.4.1 General guidelines

Installing the equipment

The installer of the equipment must create a document describing any modifications made to the equipment during installation.

Using the equipment

- *Before starting any operations on the equipment:*
  - Nominate an operations manager.
  - The role of the operations manager is to monitor, either directly or indirectly, any operations performed on the equipment and to ensure that the safety and operating instructions are respected.
  - The operations manager should read and understand all the documentation supplied with the equipment.

- *Information for personnel:*
  - Regularly reiterate the safety and operating instructions to the operating personnel.
  - Contact your dealer if you have any questions regarding the equipment and any training requests for personnel.
  - Make the manufacturer's instructions available to the users (if possible on site).

- *Protection for individuals and equipment:*
  - Wear suitable clothing.
  - Move away from equipment in operation.
  - Ensure that persons who are not authorised to intervene as well as animals are kept away from the equipment. Observe this guideline regardless of whether the equipment is in operation or stopped.
  - Protect the equipment from any fluid splashes and bad weather.
  - Before starting the equipment, refit the enclosures and close all the access doors.
  - Before starting the engine, check that the air filter is present and the correct extraction circuit for the exhaust gas.
  - Respect the current regulations relating to fuel use.
  - Under no circumstances use seawater or any other corrosive or electrolytic product in the cooling circuit.
  - Adjust the equipment according to the manufacturer's prescriptions.
  - Check that the equipment operates correctly.
  - Engage the parking brake when the equipment is installed on the operating site on its trailer. When chocking the trailer on a slope, ensure that there is nobody in the path of the trailer.

Maintaining the equipment

- *Personnel skills:*
  - Ensure that the maintenance operations are performed on the equipment by appropriately trained personnel.

- *Personnel protection:*
  - Wear suitable clothing and protective goggles.
  - Remove any personal belongings that may hinder the operation: watch, bracelet, etc.
  - Fit a panel over the controls of the equipment to prevent any attempt to start.
  - Disconnect the battery (and pneumatic starter if fitted) before beginning any maintenance operation.
  - Handle the equipment according to best practices, using techniques which do not endanger the personnel.
  - It is essential to wear gloves when detecting leaks.
  - Regularly check that the safety devices are operating correctly.

- *Equipment protection:*
  - Use tools in good condition and suited to the work to be done. Ensure you have understood the instructions before beginning any operation.
  - Respect the maintenance table and its recommendations. In dusty or unfavourable conditions, certain maintenance intervals will need to be reduced.
  - Check that the spare parts fitted on the equipment are supplied only by the dealer.
  - Handle the equipment according to best practices, using techniques which do not risk damaging the equipment.
  - Replace any safety pictograms that are missing or illegible on the equipment.

  Note: the mounting bolts on the protective devices of the rotating parts are captive bolts equipped with retaining washers. Also, in order to ensure the integrity of this assembly, it is prohibited to use electric or pneumatic screwdrivers to undo these mounting bolts.

- *Cleaning the equipment:*
  - Clean off any trace of oil, fuel or coolant using a clean cloth.
  - Use only approved cleaning solvents.
  - Cleaning products and methods that are strictly prohibited:
    - petrol or other flammable substances;
    - soapy solution containing chlorine or ammonia;
    - high pressure cleaner.

- *Additional instruction:*
  - If necessary, contact the dealer for the following reasons:
    - answers to any questions relating to the equipment;
    - training requests for personnel;
    - supplying the relevant documentation for maintenance operations;
    - supplying spare parts;
    - corrective or preventive maintenance operations.

Operating site

- *Maintenance:*
  - Clean the entire operating site regularly with suitable cleaning materials.
  - The presence of dangerous or combustible materials inside premises must be limited to the operating requirements.

- *Access:*
  - Prohibit free access to persons who are not part of the establishment, except for those designated by the user.

- *Respecting the environment:*
  - Drain and dispose of engine oil in a specially provided container (fuel distributors can collect your used oil).
  - Burning of waste in the open air is prohibited.
  - Remove waste water, sludge and other waste in a specialised processing centre.

1.4.2 Electrical safety precautions

	ELECTRICAL EQUIPMENT - RISK OF ELECTRIC SHOCKS	
DANGER		

- Read the manufacturer's identification plate carefully. The values for voltage, power, current and frequency are shown. Check that these values match the installation being supplied.
- The electrical connections must be made in accordance with current standards and regulations in the country of use and the neutral system sold.
- Ask a qualified electrician to intervene when there are specific cases requiring equipment to be connected to an existing electrical network.
- Disconnect the power to the equipment (equipment voltage, battery voltage and network voltage) before any installation or maintenance operation is performed.
- Connect the equipment wires by respecting the wiring diagram supplied by the manufacturer.
- Always handle the equipment with dry hands and feet.
- Take all the necessary precautions to avoid touching stripped cables or disconnected connectors.
- Use and maintain the cables in good condition, well insulated and connected correctly and securely.
- Only replace equipment that provides protection against electric shock with identical equipment (specifications and nominal values).
- Only use flexible durable cables with a rubber covering, which conform to ECI 245-4, or equivalent cables.
- Refit the protective plates (blanking covers) after each maintenance operation.

Note: The electrical equipment supplied with the equipment complies with standard NF C15.100 (France), or with the standards of the countries in question.

1.4.3 Safety precautions in case of electrical shock

In the event of an electric shock, observe the following instructions:

1. Avoid direct contact both with the live conductor and the victim's body.
2. Shut off the power immediately and activate the emergency stop for the equipment concerned. *Note: the live wire may be cut with an axe. Take extreme care to avoid the electric arc that will be generated by this.*
3. If it is impossible to access the equipment: move the victim away from the live conductor using a dry piece of wood, dry clothing or other non-conducting material.
4. Move the victim away from any situations where there is a danger of death.
5. Contact the emergency services.
6. If breathing has stopped, begin artificial respiration at once.
7. In the event of cardiac arrest, carry out cardiac massage.

1.4.4 Safety precautions relating to fire, burns and explosions

DANGER

FUELS / FLAMMABLE PRODUCTS / PRESSURISED FLUID

- RISK OF BURNS -
- RISK OF FIRE -
- RISK OF EXPLOSION -

1. Before starting the equipment, move any flammable or explosive products away (petrol, oil, cloth, etc.).
2. It is prohibited to put combustible materials on the hot parts of the equipment (for example: exhaust pipe).
3. Avoid any contact with the hot parts of the equipment (for example: exhaust pipe).
4. Use appropriate ventilation to allow the equipment to cool correctly.
5. Wait for the engine to stop and cool down completely before removing the radiator cap.
6. Wait for the equipment to stop and cool down completely before covering the equipment (if necessary).
7. Depressurise the air, oil and cooling circuits before removing or disconnecting all the fittings, pipes or connected components.
8. Ensure that the equipment in operation is fixed (in a stationary position).

IMPORTANT	When installing the equipment on a vehicle or other mobile equipment, a study must be conducted beforehand in order to take into account the various specific uses of the generating set.

Fuels

- Respect current local regulations regarding the equipment and fuel used (petrol, diesel and gas).
- Top up the engine with fuel when the engine has stopped (except for equipment with an automatic filling system).
- Smoking, using a flame or producing sparks are forbidden while the fuel tank is being filled.
- Use protection suitable against fires and explosions.
- Pipes must be replaced as soon as their condition demands it.

Oils

1. Check that the system is no longer pressurised before carrying out any procedures.
2. Avoid contact with hot oil.
3. Wait for the engine to stop and cool down completely before topping up the oil.
4. Before starting the engine, refit the oil filler cap.
5. It is prohibited to cover the generating set with a fine layer of oil for anti-rust protection.

Battery

- Smoking, using a flame or producing sparks are forbidden close to batteries (particularly when the batteries are being charged).

Supply gas (concerns generating sets running on gas)

- Request the user technical notes and LPG or NG safety data sheets from your gas supplier.
- For any operation on a gas installation, ask a recognised specialist to intervene.
- Gas supply procedures must be carried out in the open air (outside) in accordance with local regulations, in an area well away from fires, people or animals.
- Check the sealing of the gas supply circuit using soapy water with the circuit pressurised, or using a leak detector.
- It is forbidden to smoke, bring flames near or create sparks when the tank is being filled, and near to the generating set.

1.4.5 Toxic risk safety precautions

DANGER

EXHAUST GAS - TOXIC PRODUCTS

- TOXIC RISK -

Exhaust gas

- Use suitable ventilation to release the exhaust gas outside and prevent it from accumulating.
- Respect current local regulations regarding the equipment and fuel used (petrol, diesel and gas).
- Periodically examine the burnt gas exhaust.
- Pipes must be replaced as soon as their condition demands it.

Note: the carbon monoxide present in the exhaust gas may lead to death by inhalation if the concentration levels in the atmosphere are too high.

Corrosion inhibitor in the coolant *(contains alkali)*

- Read the instructions on the packaging.
- Keep the product out of the reach of children.
- Do not swallow it.
- Avoid prolonged or repeated contact with the skin.
- Never allow contact with the eyes.

In the event of contact with the eyes:

1. Rinse immediately with plenty of water for at least 15 minutes.
2. Consult a doctor immediately.

In the event of contact with the skin:

1. Wash thoroughly with water and soap.
2. Consult a doctor immediately.

Fuels and oils

- Do not swallow it.
- Ensure proper ventilation.
- Use a suitable protective mask.

Battery electrolyte

- Avoid all contact with the skin and eyes.
- Wear suitable protective goggles and clothing and strong alkali-resistant gloves for handling the electrolyte .

If splashes get into the eyes:

1. Rinse immediately with running water and/or a 10% diluted boric acid solution.
2. Consult a doctor immediately.

1.4.6 Precautions for risks relating to handling phases

	DANGER	
	HANDLING PHASES - RISK OF DROPPING	

1. Select the appropriate handling equipment and apparatus according to the type of equipment being handled. Check that there is sufficient handling capacity.
2. Check that the handling equipment and apparatus are in good operating condition.
3. Respect the handling instructions described in the present documentation and the pictograms displayed on the equipment to be handled.
4. Be sure never to stand under the load being handled.

Note: the lifting rings provided on the equipment are designed to handle the generating set alone. If additional equipment is fitted to the generating set, a study should be conducted in order to define the centre of gravity of the assembly and to check the correct mechanical performance of the structure and its lifting rings.

1.4.7 Precautions for risks relating to noise

DANGER	**HIGH SOUND LEVEL - RISK OF HEARING LOSS**	

- Always use suitable ear defenders when working in close proximity to a generating set which is in operation.

Note: for generating sets used inside, for which the ambient noise levels are dependent upon the installation conditions, it is not possible to specify these ambient noise levels in the operating instructions. As prolonged exposure to high sound pressure levels can cause permanent damage to hearing, it is necessary to measure the acoustics after installation in order to determine the sound pressure level and, if necessary, to implement the appropriate preventive measures.

2. General description

2.1. Description

Overview

Figure 7 : General description of the generating set

1	Control unit	4	Drawbar
2	Product information plate	5	Lifting ring
3	Forklift grooves	6	Access to maintenance area

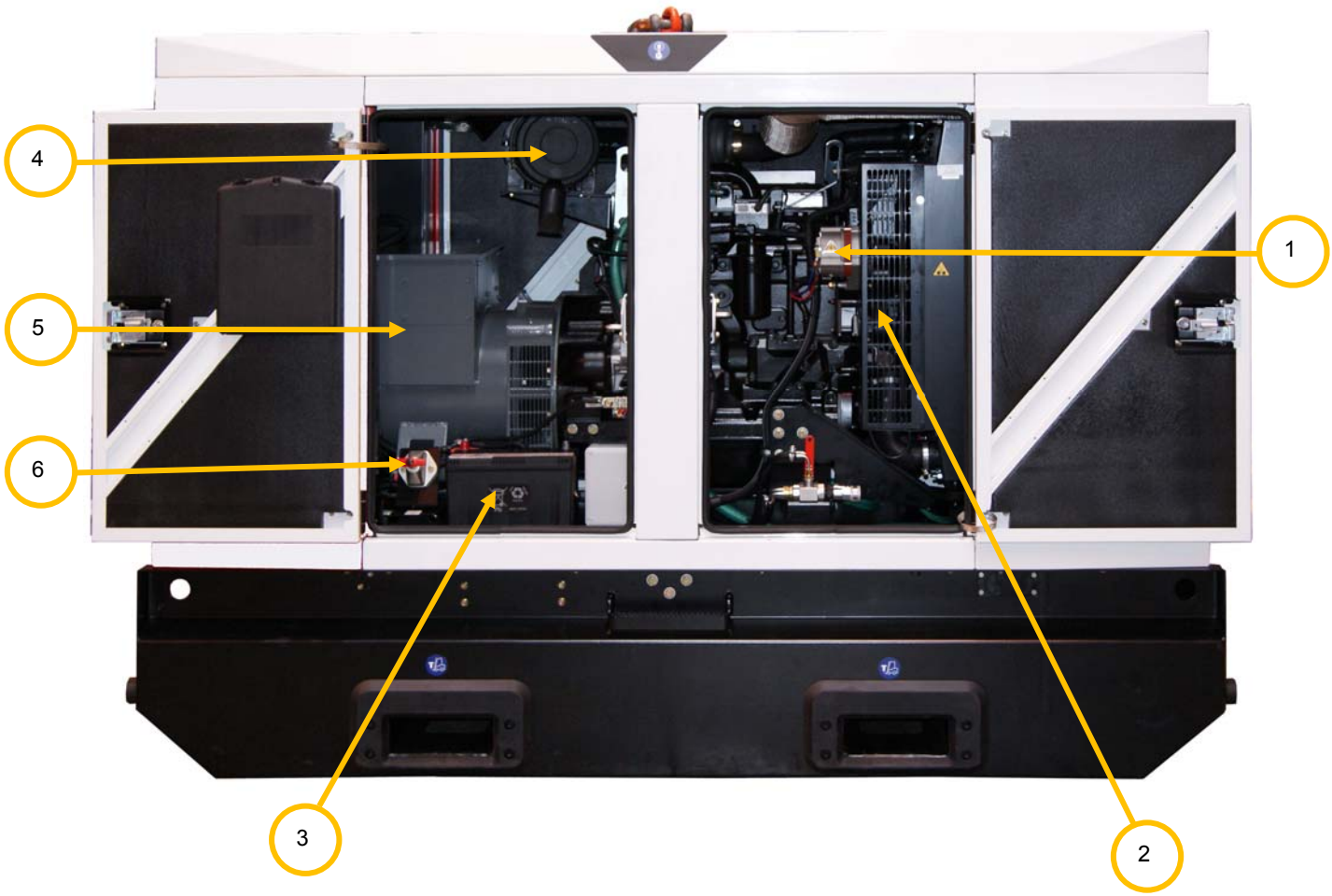


Figure 8 : General description of the generating set

1	Charging alternator	4	Air filtration
2	Protective grille	5	Alternator
3	Starter battery	6	Battery isolating switch

Control

Figure 9 : General description of the generating set (control)

1	Control unit	4	Working hours counter
2	Emergency stop	5	Power circuit breaker
3	Socket control panel	6	Connection terminal block

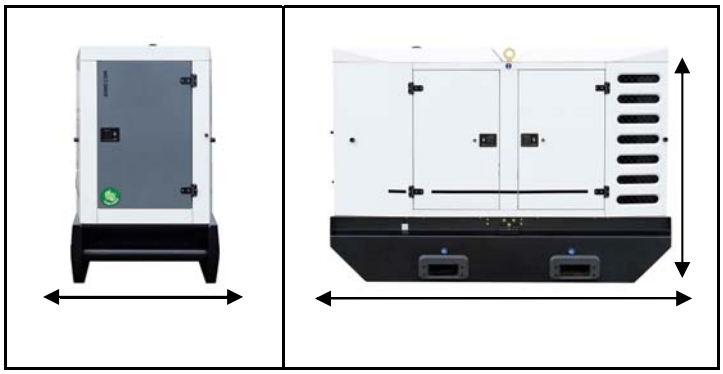
Note: Photo presented with the Nexys control unit.

2.2. Technical specifications

Range / Generating set type	RENTAL POWER / R66C2C

Weights and Dimensions

Dimensions with high autonomy tank



Dimensions l x w x h:
2545 mm x 1150 mm x 1824 mm

Weight:
1650 kg dry weight / 2024 kg in operating configuration

Hood:
M3128

Sound pressure level (LpA) at 1 m : 72 dB(A)
Measurement uncertainty: 0.70

Output

Voltage	Hz	Phase	Load factor	Max current (A) Emergency	Emergency power [1] kW / kVA	Prime power [2] kW / kVA
400/230	50	3	0.8	95	52.8 / 66	48 / 60

(1) ESP: Stand-by output available for emergency use under variable charge up to 200hrs per year as per ISO 8528-1, no overload available under these service conditions.

(2) PRP: Main output available continuously under variable load for an unlimited time period per year as per ISO 8528-1, an overload of 10% one hour every 12 hours is available, as per ISO 3046-1.

- Term of use :

Standard reference conditions ESP/PRP 40° / 40°, Air Intlet Temp, 1000m / 1000m mA.S.L. 60 % relative humidity.

Engine data	
Manufacturer / model	JOHN DEERE 4045TFS70
Type	Turbo
Cylinder configuration	4 X L
Cubic capacity	4.48 L
Rotation speed	1500 Rpm
Max emergency/prime power at nominal speed	61 / 55 kW
Adjustment type	Mechanical

Fuel consumption	
110 % (emergency power)	16.09 L/h
100 % main power	14.75 L/h
75 % main power	11.26 L/h
50 % main power	7.41 L/h

Fuel	
Fuel type	Diesel
High autonomy fuel tank	390 L

Lubrication	
Oil consumption (100 % load)	0.040 L/h

Cooling	
Fan power	0.7 kW
Refrigerant type	Gencool
Thermostat	82-94 °C
Engine capacity with radiator	8.50 L
Max coolant temperature	105 °C

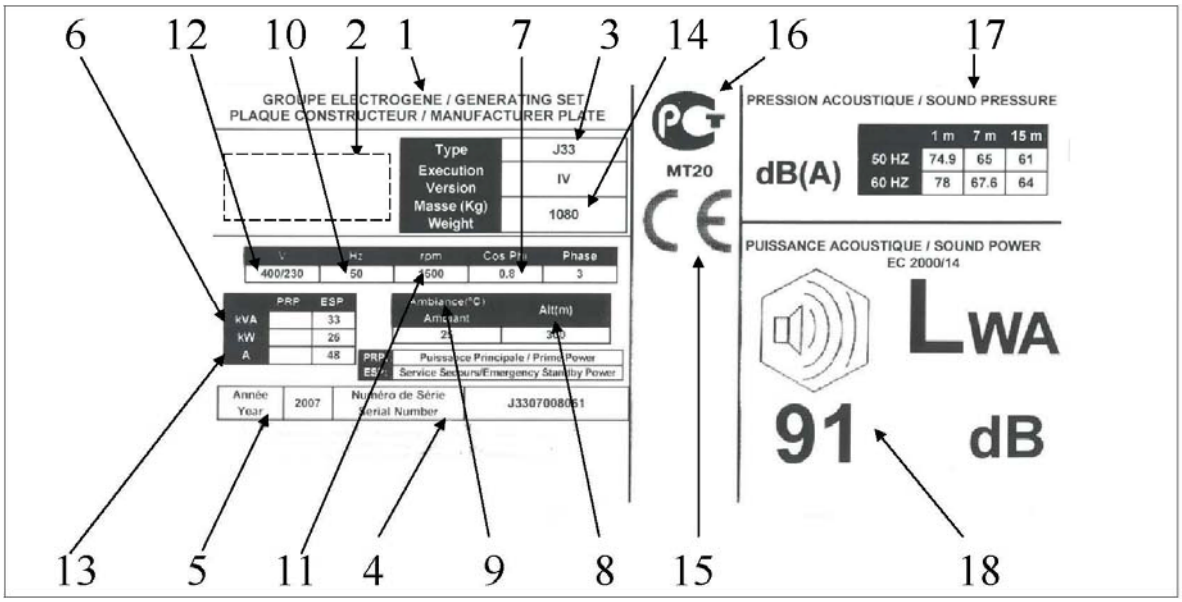
Alternator data	
● Compliant with NEMA MG21 standards, UTE NF C51 111, VDE 0530, BS 4999, IEC 34.1, CSA	● The alternator is protected against short circuits ● Vacuum impregnation, epoxy winding, IP23 protection rating
Type	LEROY SOMER LSA432M45 - AR - F12
Number of phases	3
Power factor (cos Phi)	0.8
Number of poles	4
Excitation type	AREP
Insulation classe	H
Number of bearings	1
Coupling	Direct

Control unit(s)	
NEXYS 	Standard specifications: Frequency meter, Voltmeter, Ammeter Alarms and faults: Oil pressure, Coolant temperature, Fail to start, Overspeed, Alternator min/max, Fuel level low, Emergency shutdown Engine parameters: Working hours counter, Engine speed, Battery voltage, Fuel Level, Air Preheating
TELYS 	Standard specifications: Voltmeter, Ammeter, Frequency meter Alarms and faults: Oil pressure, Water temperature, Start failure, Overspeed, Alternator min/max, Battery voltage min/max, Emergency stop Engine parameters: Timer, Oil pressure, Water temperature, Fuel level, Engine speed, Battery voltage

2.3. Identifying sets

Generating sets and their components are identified by means of identification plates.

The precise rules for identifying each major component (engine, alternator, etc.) are set out in each manufacturer's documentation contained in the appendices of this manual.



1 - Generating set	9 - Maximum ambient temperature for the rated power (°C)
2 - Manufacturer name	10 - Rated frequency (Hz)
3 - Model	11 - Generating set rotation speed (RPM)
4 - Serial number	12- Rated voltage (V)
5 - Year of manufacture	13 - Rated current (A)
6 - Rated output (kVA and kW) according to the ISO 8528-1 standard PRP: main power ESP: emergency power	14 - Weight (kg)
7 - Rated power factor	15 - CE marking
8 - Maximum altitude of the site above sea level (m) for the rated power	16 - Non CE standard marking (e.g.: GOSSTANDART)
	17 - Sound pressure
	18 - Sound power

Figure 10 : Example of a generating set identification plate

2.4. Fluid retention

Any outflow of the fluids contained in the generating sets (fuel, oil and coolant, or rainwater or condensation) will be collected in a retention container.
The containers have a capacity which allows 110% of the fluids contained in the generating set fitted with this option to be collected.

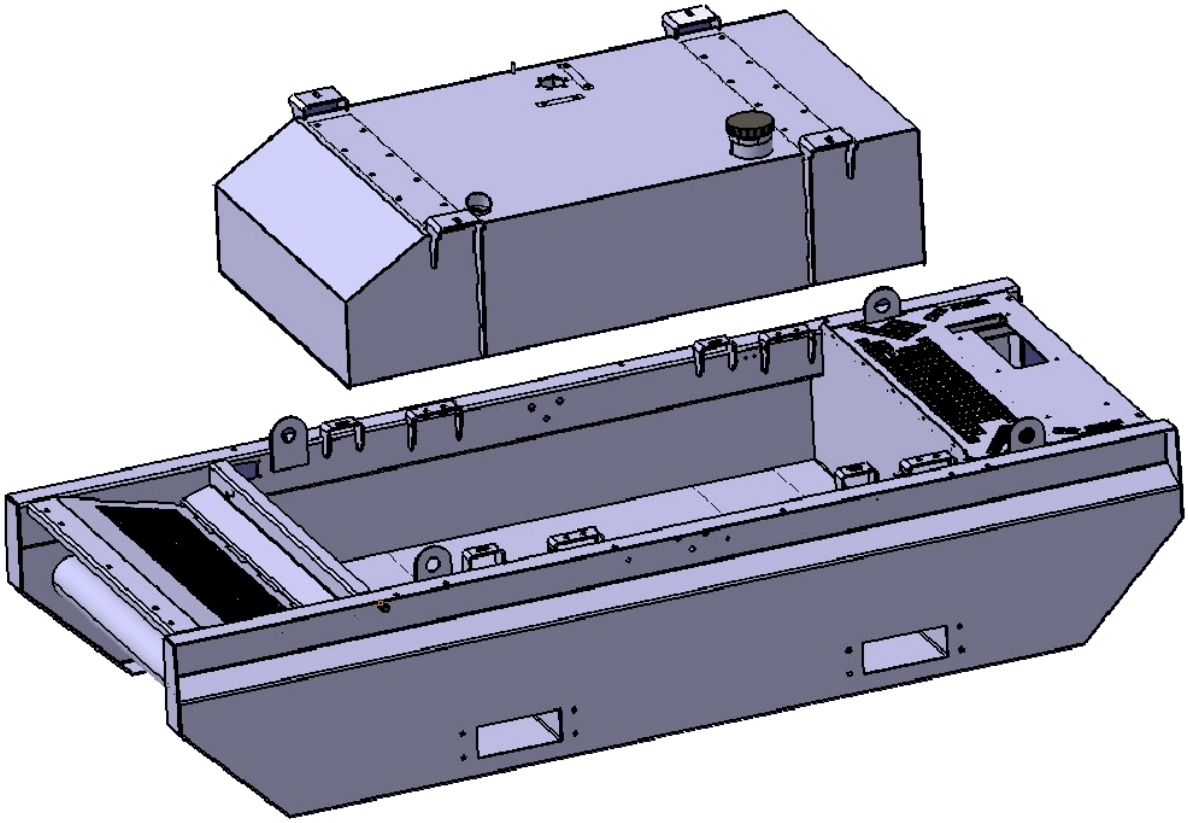


Figure 11 : Fluid retention container

The generating sets are fitted with a visual alarm warning when the upper limit of the retention container has been reached.

In all cases, the retention containers must be regularly checked to ensure they contain no fluid (fuel, oil and coolant, or rainwater or condensation). If necessary, drain the containers via the drain port.

- ✓ **Note**: Never allow these fluids to drain onto the ground; ensure they are collected in a designated container.

2.5. Fuels, lubricants and coolants

All specifications (product features) are given in the engine and alternator maintenance manuals attached to this manual.

In addition to these, we recommend the fuels, lubricants and coolants mentioned in the "Specifications" section.

2.5.1 Fuel specifications

General quality requirements

The quality of the fuel is essential for engine performance. It affects the technical performances such as the service life, power supplied and fuel consumption as well as the ability to respect the requirements issued by authorities relating to pollutant emissions. **Only fuels which conform to the current legal requirements and national and international standards should be used**. Consult the local fuel distributor to find out the characteristics of the diesel fuel available in the area.

Examples of standards and requirements:

EN 590	European standard (CEN) for vehicle fuel - fuels for diesel engines (diesel fuel) - requirements and test methods
ASTM D 975 1-D and 2-D	American Society for Testing and Materials: basic requirement in the United States and Canada
JIS KK 2204	Japanese Industrial Standards: Japanese industrial standards

Respecting pollutant emissions

The certification measures confirming that the legal emission value limits are respected are performed with certified fuels which conform to the standards and requirements stated above.

Resistance to low temperatures

When the external temperature is low, the fluidity of diesel fuel may no longer be sufficient due to paraffin deposits. Also, in the winter in order to avoid malfunctions (for example, clogged filters), use diesel fuels which are fluid enough in cold weather.

The requirements to respect for the various geographical regions and various seasons (winter/summer) are specified in the standards and/or national regulations. Petrol companies should always supply fuels with the correct flow properties regardless of the time of year. In general, diesel fuel is treated with additives so that the fuel can be used at low temperatures in the region where it is marketed.

Treating fuel with additives must respect the engine manufacturer's recommendations and maintain a suitable lubricity for the injection systems. It is recommended to favour fuels whose additives have been added in a refinery over those modified in the storage tank.

General specifications for diesel fuel

The fuel used must have the following characteristics (non-exhaustive list):

Sulphur content	The sulphur content must meet the current emissions regulations in the region where the generating set is used. ***For the United States and countries respecting the EPA regulation*** Only use Ultra Low Sulphur Diesel (ULSD) fuel with a maximum sulphur content of 15 mg/kg for Interim Tier 4 and Tier 4 certified engines. ***For the European Union*** Directive 2009/30/CE whose aim is to limit atmospheric pollution, imposes the use of a diesel fuel with a very low sulphur content of 10 mg/kg, for non road mobile machinery. In France, this obligation has resulted in the development of a diesel fuel called "off road diesel fuel" or "*GNR*". The maximum admissible sulphur content is 10 mg/kg. However, member states allow these diesel fuels to contain up to 20 mg/kg of sulphur when they are distributed to the final users. It is recommendable to avoid storing off road diesel fuel for long periods of time (over 6 months).
Viscosity and density	The viscosity and density directly affect the performance (power and fuel consumption), emissions and service life of the engine. A low level of viscosity and density reduces engine power and increases fuel consumption. Too high a level of viscosity and density seriously reduces the service life and operation of the fuel injection system. In order to maintain adequate technical and environmental performance, the viscosity and density must conform to the specifications indicated in the manufacturer's instructions for the engines fitted to our generating sets.
Lubricity (or capacity for lubrication or oiliness)	In order to protect the fuel injection system against excessive wear, the fuel must have satisfactory lubricity (refer to the manufacturer's instructions for the engines fitted to our generating sets).
Cetane index	The ignition behaviour of diesel fuels is described by the cetane index. The cetane index is important for emissions, the ability to start in cold weather and engine noises. The minimum technical requirements are 45.
Water and contaminants	The fuel and tank must not contain any water. Water causes the engine parts to corrode and wear more rapidly, particularly the injection system parts. In addition, water promotes the growth of bacteria and fungi in the tank, which can clog the fuel filter. The fuel must not contain any type of residue. Organic contaminants (bacteria, fungi, etc.) can block the fuel filters; inorganic material in the fuel (dust, sand) can cause serious damage to the injection equipment.

2.5.2 Lubricant specifications

Essential for the correct operation of the engine. The oil should be selected according to its use. Besides the lubrication function, oil should also:

- cool certain parts;
- protect metal parts against corrosion;
- improve the sealing, in particular between pistons, piston rings and cylinders;
- remove impurities (to the filter).

It is recommendable to use a top of the range lubricant for diesel engines. The table below lists the oils recommended for each engine manufacturer.

Engine			
Make	Type	Make	Type
Cummins	All	GenPARTS	GENLUB TDX 15W40
John Deere	All	John Deere	John Deere PLUS-50
		GenPARTS	GENLUB TDX 15W40
MTU	All	GenPARTS	GENLUB TDX 15W40
Mitsubishi	All	GenPARTS	GENLUB TDX 15W40
Perkins	Fuel	GenPARTS	GENLUB TDX 15W40
	Gas	MOBIL	PEGASUS 705
Volvo	All	GenPARTS	GENLUB TDX 15W40
Doosan	All	GenPARTS	GENLUB TDX 15W40
Lombardini Kohler	All	GenPARTS or Kohler	GENLUB TDX 15W40 or Kohler 5W40, according to the model of the engine

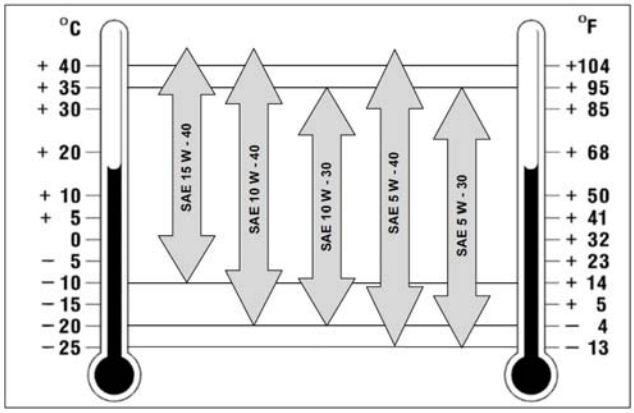
Viscosity

Viscosity is a measure of the flow resistance of a fluid. The viscosity of an engine oil is expressed by 2 SAE (Society of Automotive Engineers) grades. One grade for cold weather and one grade for hot weather. The grade for cold weather appears before the letter W.

The 1st grade represents dynamic viscosity in cold weather, namely the ability to start the engine and to prime the oil pump (and therefore to lubricate the various components quickly). The lower the number, the more fluid the oil.

The 2nd grade represents the kinematic viscosity in hot weather. The higher the number, the thicker the film of oil when hot (which aids protection and sealing). The lower the number, the less friction there will be in hot weather (it helps to save fuel).

In order to ensure immediate protection when starting the engine, the choice of viscosity grade when cold is essential. More fluid oil is quicker to flow when oil begins to circulate through the engine. It should be selected according to the ambient temperature. See the table below.



Characteristics of GENLUB TDX 15W40 oil

Performance

GENLUB TDX oil is a 15W40 multigrade mineral oil which meets the following specifications: ACEA E3 and API CG-4.

ACEA E3: oil with superior viscosity stability, suited to extended oil change intervals and severe conditions of use.

API CG-4: oil particularly effective to meet the emissions requirements.

ACEA = European Automobile Manufacturers' Association

API = American Petroleum Institute

Specifications

Specifications	Units	Grade SAE 15W-40
Density at 15°C	kg/m^3	883
Kinematic viscosity at 100°C	mm^2/s (cSt)	14
Viscosity index	–	130
Flow point	°C	- 27°
Flash point	°C	>200
TBN*	mgKOH/g	9.7

Typical values given for information purposes

** TBN (Total Base Number – degree of alkalinity): a measure of a lubricant's reserve alkalinity according to standard ASTMD 2896. This check makes it possible to assess the ability of the product to remain in service and to check the 'capacity of the lubricant to neutralise the acidity contained in the oil, which may corrode the metallic elements of the lubricated component.*

2.5.3 Coolant specifications

The engine's internal cooling system allows the engine to operate at a precise temperature.

The table below lists the coolants recommended for each engine manufacturer.

Engine			
Make	Type	Make	Type
Mitsubishi	All	Mitsubishi	LLC
		GenPARTS	GENCOOL PC -26
MTU	All	GenPARTS	GENCOOL PC -26
John Deere	All	GenPARTS	GENCOOL PC -26
Volvo	All	GenPARTS	GENCOOL PC -26
Doosan	All	GenPARTS	GENCOOL PC -26

Specifications of GENCOOL PC -26 coolant

Performance

GENCOOL PC -26 coolant is a ready-to-use cooling fluid which provides a high level of protection and is produced from an antifreeze approved by the majority of manufacturers (Power Cooling concentrated antifreeze).

It offers the following:

- Improved anticorrosion: improves the effectiveness and service life of the cooling system.
- High temperature feature: promotes heat exchange.
- Long-term protection: against overheating and corrosion under extreme conditions of use.
- Compatible with the original fluid (however, it is recommended to drain the entire cooling system when replacing the fluid).

Specifications

Specifications	Units	Characteristics
Density at 20°C	kg/m^3	1053 ± 3
pH	pH	7.5 to 8.5
Alkalinity reserve	ML	≥ 10
Boiling temperature	°C	105 ± 2
Freezing temperature	°C	-26 ± 2

Typical values given for information purposes

3. Transporting the equipment

3.1. Warnings concerning transport

	It is prohibited to operate generating sets whilst they are being transported.
IMPORTANT	

3.2. Preparing for transport

Before the equipment is transported, perform the following operations:

1. Close the tap on the oil top up tank outlet.
2. Fill up the oil top up tank with oil.
3. Fill up the crankcase with oil.
4. Fill up the on-board tank with fuel.
5. Check that the batteries are fitted and filled with electrolyte.

3.3. Road transport

3.3.1 Generating sets with and without an enclosure

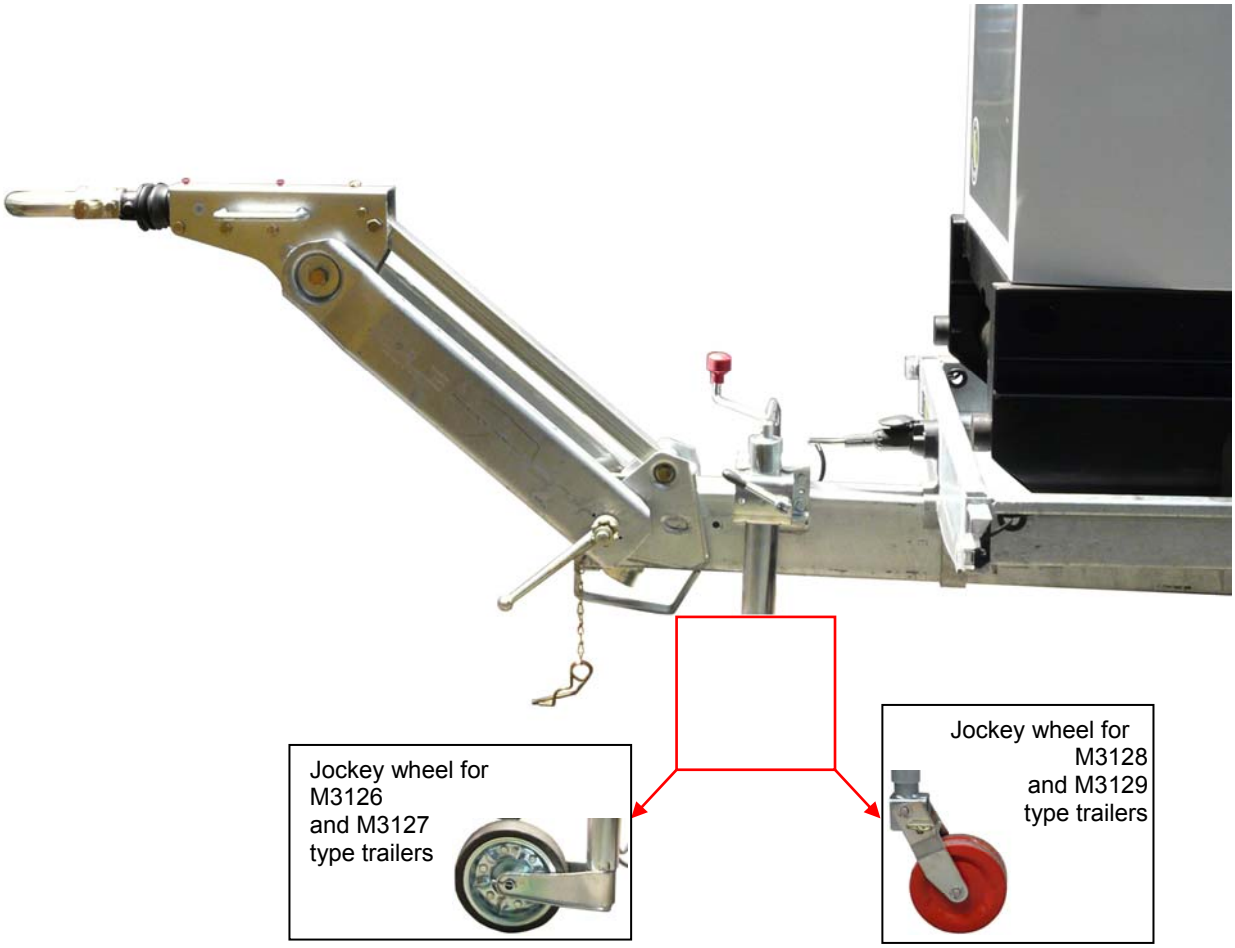
Generating sets must be transported by road in accordance with the regulations of the countries concerned.

When transporting generating sets in containers by road, the following steps must be observed:

1. Put a plastic cover over non-enclosed generating sets during transportation.
2. Select transport equipment (trailer, semi-trailer, etc.) suitable for this usage and having all the safety guarantees in terms of load bearing capacity and of the securing devices.
3. Chock and fix the generating sets to the floor of the transport equipment.
4. Strap the generating sets to the transport equipment.
5. Select a transport route which makes it possible to travel on roads suitable for vehicles, and whose quality will not damage the on-board generating sets.

3.3.2 Generating sets on trailers

3.3.2.1. Hitching and unhitching the trailer

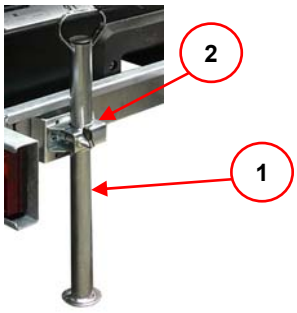


Before hitching the trailer, check the hitching system on the towing vehicle; this must be perfectly compatible with the trailer.

IMPORTANT	Towing a trailer with a non-compliant device (bar, cables, lashing, etc.) runs the risk of serious accidents. Also check: ✓ That there are no incipient ruptures or significant wear on the hitching system. ✓ That the locking system is working properly.

Hitching a trailer fitted with a hitching ring

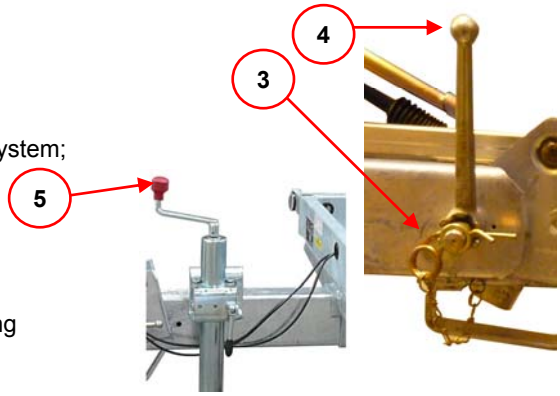
1. Drive the towing vehicle or bring the trailer up to the hitching point, then:
   - With the jockey wheel touching the ground, place the stabiliser (1) in the top position:
     - ➢ Loosen the jaw of the stabiliser (2) with its lever;
     - ➢ Raise the stabiliser fully;
     - ➢ Tighten the jaw of the stabiliser (2) with its lever.
   - Remove the wheel chocks if necessary and store them.
2. Position the trailer parallel to the ground using the guide wheel handle (jockey wheel).
3. Place the hitching ring above the towing vehicle's hitching system:



IMPORTANT	After this adjustment, the trailer must remain parallel to the ground. Make any necessary height adjustments to the towbar using the jockey wheel to enable hitching.

- Remove the safety pin from the towbar (3);
- Undo the nut with the lever (4);
- Use the adjustable towbar handle to place the ring above the hitching system;
- Tighten the nut to lock the towbar;
- Fit the towbar safety pin.

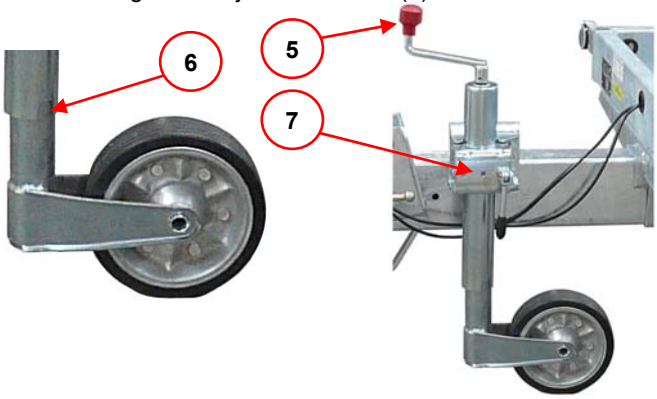
4. Attach the ring to the hitching system:
   - Lower the trailer by moving the jockey wheel away from the ground using its handle (5).
5. Lock the jockey wheel in the towing position:



IMPORTANT	When in the towing position, the jockey wheel must not: - obstruct the unlocking cable's movement; - trap any electrical cables.

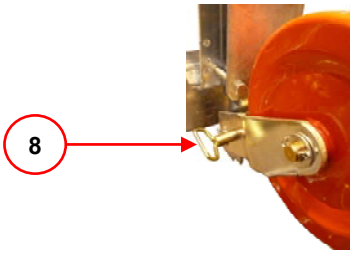
M3126/M3127 type trailers

- Position the jockey wheel at the rear.
- Raise the jockey wheel with its handle (5) into the notches on its tube (6).
- Loosen the jaw of the tube (7) with its lever.
- Raise the tube fully.
- Tighten the jaw of the tube (7) with its lever.

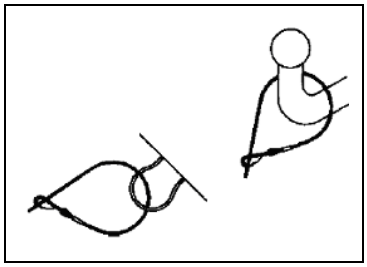


M3128/M3129 type trailers

- Remove the safety pin from the position lock (8).
- Remove the position lock (8).
- Place the jockey wheel in the towing position.
- Fit the position lock (8).
- Fit the safety pin in the position lock (8).
- Raise the jockey wheel with its handle fully and at right angles to the towbar.



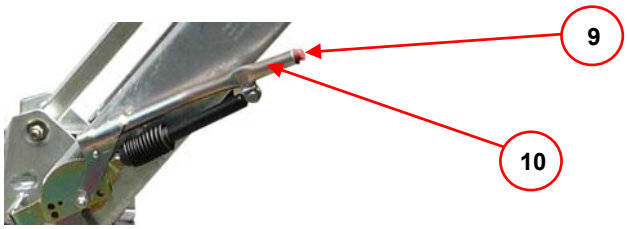
6. Attach the unlocking cable to the hitching plate on the towing vehicle.



Examples of how to attach the hitching cable

!	If the hitching ring is not correctly connected to the hitching hook, the trailer will become separated from the towing vehicle. In this case the unlocking cable actuates the parking brake (which then becomes an emergency brake).
IMPORTANT	To ensure that the device fulfils its function correctly, the unlocking cable: - MUST NOT be wound around the jockey wheel, as this will disable emergency braking; - MUST NOT be taut or obstructed, as this could activate emergency braking during towing; - MUST be routed as straight as possible and not be obstructed at any point; - MUST be sufficiently long to allow cornering.

7. Connect the electrical cable plug controlling the lamps, indicators, etc. to the socket on the towing vehicle.
8. Remove the parking brake:
   - Remove the wheel chocks if necessary and store them;
   - Perform the following operations simultaneously on the parking brake:
     - ➢ Press the unlocking button (9);
     - ➢ Lower the handle (10) fully.

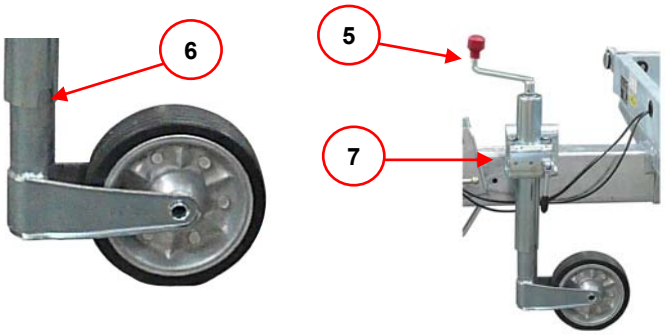


Unhitching a trailer fitted with a hitching ring

1. Immobilise the trailer:
   - Chock the wheels;
   - Apply the parking brake:
     - ➢ Raise the parking brake lever (10) fully.
2. Disconnect the electrical cable plug controlling the lights, indicators, etc. from the socket on the towing vehicle.
3. Remove the unlocking cable on the towing vehicle.
4. Release the hitching ring:

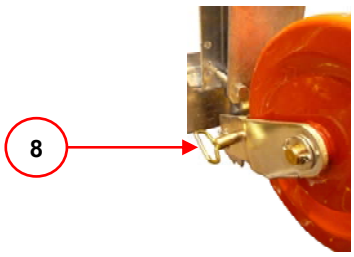
M3126/M3127 type trailers

- Disengage the jockey wheel from the notches in the tube (6) with its handle (5).
- Loosen the jaw of the tube (7) with its lever.
- Lower the tube until the jockey wheel touches the ground.
- Tighten the jaw of the tube (7) with its lever.

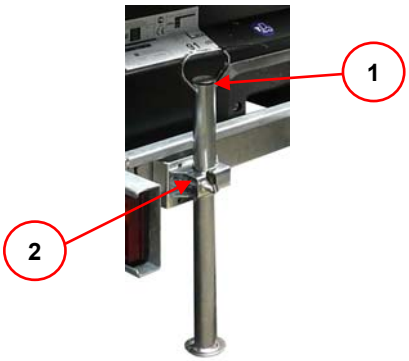


M3128/M3129 type trailers

- Remove the safety pin from the position lock (8) on the jockey wheel.
- Remove the position lock (8).
- Place the jockey wheel in the bottom position.
- Fit the position lock (8).
- Fit the position lock pin.
- Lower the jockey wheel to the ground with its handle.



   - Support the load on the jockey wheel:
     - ➢ Lower the jockey wheel with its handle;
     - ➢ When you are sure that the wheel can bear the load (the towbar rises), unhitch the trailer from the vehicle.
5. Fit the stabiliser (1):
   - Loosen the jaw of the stabiliser (2) with its lever;
   - Place the stabiliser in contact with the ground;
   - Tighten the jaw of the stabiliser (2) with its lever.



3.3.2.2. Check before towing

IMPORTANT	**Before first use, it is essential to check the tightness of the wheel bolts.**

Before towing, check the following:

- Wheel tightness.
- Hitching hook locked.
- Tyre pressure.
- Signalling lights working.
- Enclosure doors closed.
- Parking brake released.
- Guide wheels (jockey wheels) and stands lifted and locked.
- Safety cable fitted.

INFLATION PRESSURE (BAR)			
145R13	2.2	185R14C	4.5
155 / 70R13	2.5	195R14C	4.5
185 / 70R13	2.5	215R14C	4.5
175R14C	4.5	215 / 75R14C	4.5

TIGHTENING TORQUE WHEELS	
Axis of 10	60 Nm
Axis of 14 and 16	120 Nm

3.3.2.3. Operation

The driving speed must be suited to the condition of the road and the handling of the trailer.

Maximal speed on road: 140km/h.

Driving at high speed causes the tyres to heat; it is therefore important to stop from time to time and check them. Excessive heating may cause a puncture, and therefore a serious accident. For reversing manoeuvres, remember to lock the inertia brake.

	Particular attention must be paid to the tightness of the wheels on new vehicles. In the first few miles' driving, heating of the brake hubs and drums will actually reduce the wheel tightness. It is therefore essential to check the tightness every 6 miles (10 kilometres) until no further loosening is noted.
IMPORTANT	The tightness check must nonetheless be carried out whenever you have towed the trailer.

Lights / signalling

Warning lights are obligatory for on-road driving. Signalling must comply with regulations in force in the country of use.

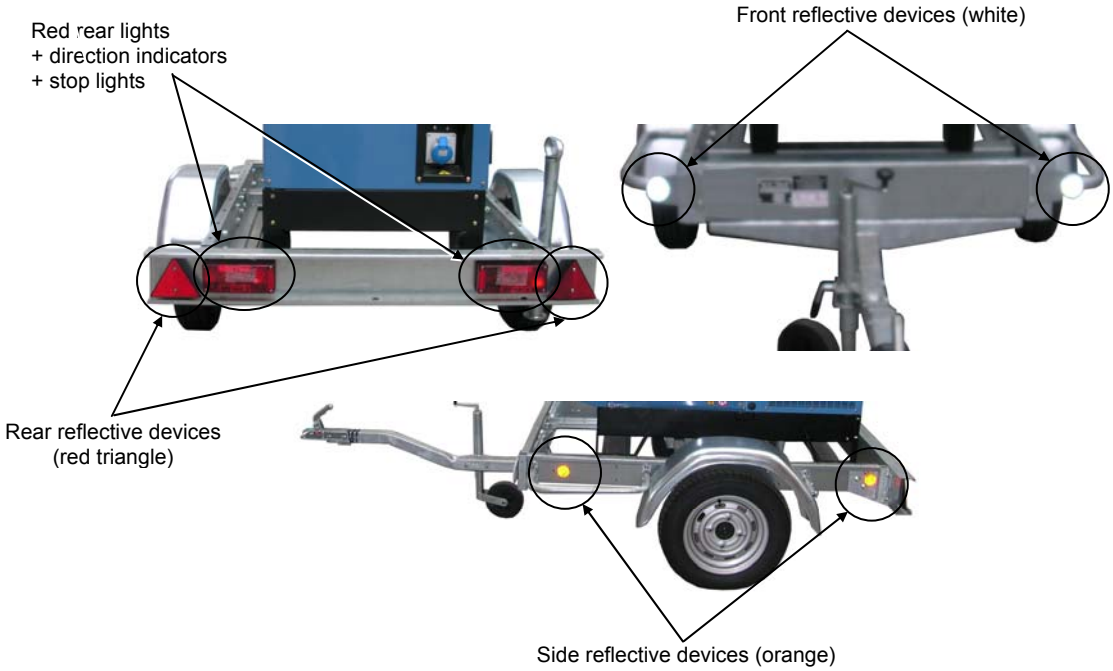


Figure 12 : Example of French signalling

3.4. Rail transport

3.4.1 Generating sets with and without an enclosure

Generating sets must be transported by rail in accordance with the specific rules governing rail transport.

When transporting generating sets in containers by rail, the following steps must be observed:

1. Put a plastic cover over non-enclosed generating sets during transportation.
2. Choose transport equipment appropriate for this usage, and having all the safety guarantees both in terms of load-bearing capacity and securing devices.

3.5. Shipping

3.5.1 Generating sets with and without an enclosure

Transportation must be carried out in accordance with the rules of shipping. Generating sets must be transported in a shipping container.

When shipping generating sets in containers, the following steps must be observed:

1. Choose transport equipment appropriate for this usage, and having all the safety guarantees both in terms of load-bearing capacity and securing devices.
2. In the case of a grouped load container, SEI cases must be used for packing.

3.6. Air transport

Containers must be transported by air in accordance with the specific rules governing air transport.

The UN has classified generating sets as "dangerous goods" listed under UN code 3166 - class 9 - "Engine, internal combustion (flammable liquid powered)".

Any air shipment of generating sets must be subject to prior declaration to the air freight company, in accordance with form MOD3909.

For air transport, observe the following steps:

1. Choose transport equipment appropriate for this usage, and having all the safety guarantees both in terms of load-bearing capacity and securing devices.
2. For control boxes, packing in an SEI 4 C case (solid case with waterproof cover) is obligatory.

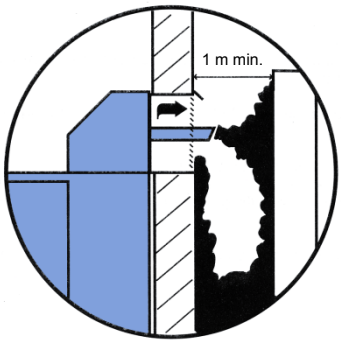
4. Installation - Connections

4.1. Unloading the generating set

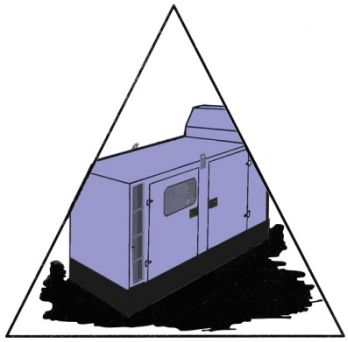
4.1.1 Choosing the location

When choosing where to site the generating set, bear in mind the:

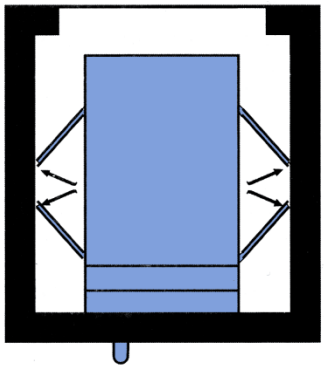
- proximity to the electrical distribution panel;
- nuisance caused by the noise;
- fuel supply;
- burnt gas evacuation;
- direction of these gases and the noise generated.



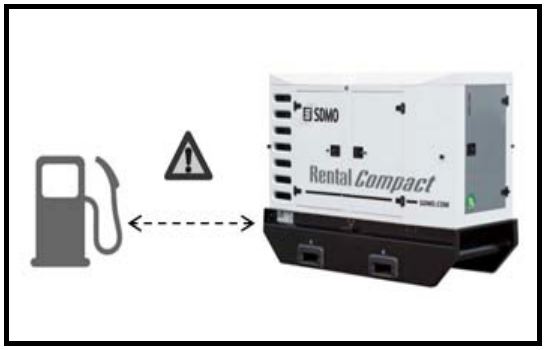
Incorrect ventilation and exhaust



Building or terrain too rough
Generating set incorrectly seated



Impossible to open enclosure doors



Impossible to fill with fuel

Figure 13 : Examples of problems that may be encountered

4.1.2 Safety during unloading

IMPORTANT	Always follow the safety instructions before unloading

- The lifting machinery or equipment is suitable for the work required and the weight of the generating set. This is indicated on the generating set's identification plate.
- The sling is correctly positioned in the central lifting eye or the lifting arms are correctly positioned in the fork-lift pockets intended for this purpose.
- The ground is able to bear the load of the generating set and its lifting machinery without stress (otherwise lay down stabilising beams of sufficient strength).
- The generating set is put down as close as possible to its place of use or transport, in a clear space with free access.

Example of equipment to be used:

- ✓ crane;
- ✓ slings;
- ✓ lifting beam;
- ✓ safety hook;
- ✓ shackles;
- ✓ Forklift truck.

4.1.3 Unloading the generating set

IMPORTANT	Before unloading or moving generating set, check that the handling equipment used is able to bear the weight of the generating set (shown on the generating set's identification plate.

4.1.3.1. Slings

1. Attach the sling on the lifting equipment to the ring on the generating set (no. 1) provided for this purpose. Tension the slings slightly.
2. Check that the sling is correctly attached and the equipment is steady.
3. Lift the generating set carefully.
4. Direct the generating set towards the chosen location and stabilise it.
5. Carefully set down the equipment while continuing to position it.
6. Release the sling, then detach it.

4.1.3.2. Fork lift truck

1. Position the arms of the forklift truck in the forklift pockets (no. 2).
2. Lift the equipment, handling it gently.
3. Set down the generating set in its unloading position.

Figure 14 : Points used for lifting and moving

4.1.4 Moving the generating set

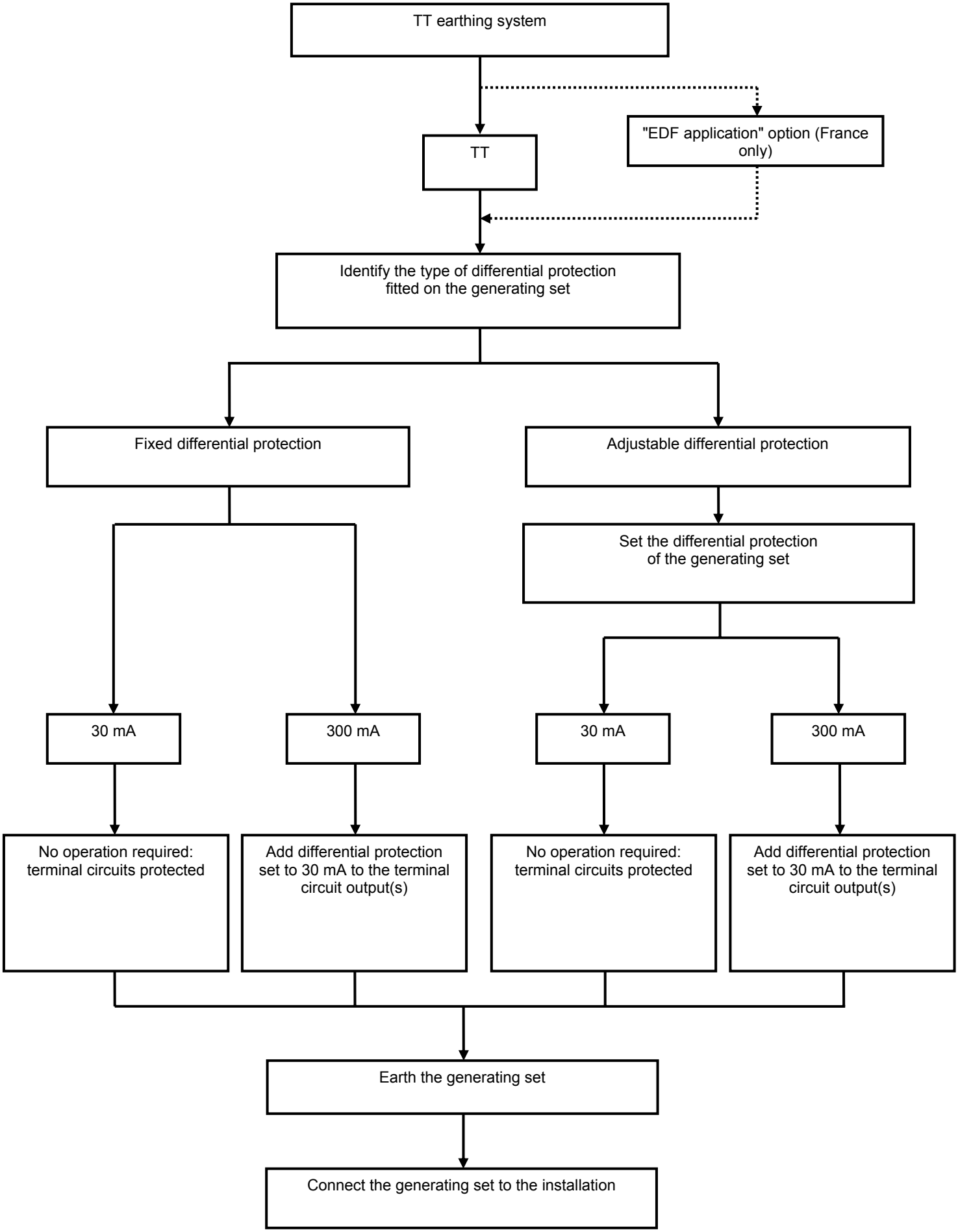
Whenever moving the generating set, ensure suitable equipment is used (e.g. sling, forklift, etc.) and identify those parts on the generating set which can be used to move it:

- lifting eye (no.1);
- forklift grooves (no.2);
- tow bar (no.3).

4.2. Connecting the generating set

4.2.1 Connection summary

This diagram can be used to retrace the different steps enabling the generating set to be correctly connected.


TT earthing system
TT
"EDF application" option (France only)
Identify the type of differential protection fitted on the generating set
Fixed differential protection
Adjustable differential protection
Set the differential protection of the generating set
30 mA
300 mA
30 mA
300 mA
No operation required: terminal circuits protected
Add differential protection set to 30 mA to the terminal circuit output(s)
No operation required: terminal circuits protected
Add differential protection set to 30 mA to the terminal circuit output(s)
Earth the generating set
Connect the generating set to the installation

4.2.2 Protecting people and equipment

4.2.2.1. Earthing system principle

The **Earthing system**, or **SLT** (formerly **Neutral system**) of the electrical installation defines the situation of the generating set neutral in relation to earth and the grounds of the electrical installation at the user end.

Our generating sets are designed to operate with the TT system (or EDF application depending on the option, for France only).

4.2.2.2. TT system

In the TT earthing system, automatic power cut-off via a Residual Current Device (RCD) is obligatory at the upstream part of the installation, to ensure that personnel are protected (additionally, a maximum 30 mA device must be installed on outlet circuits).

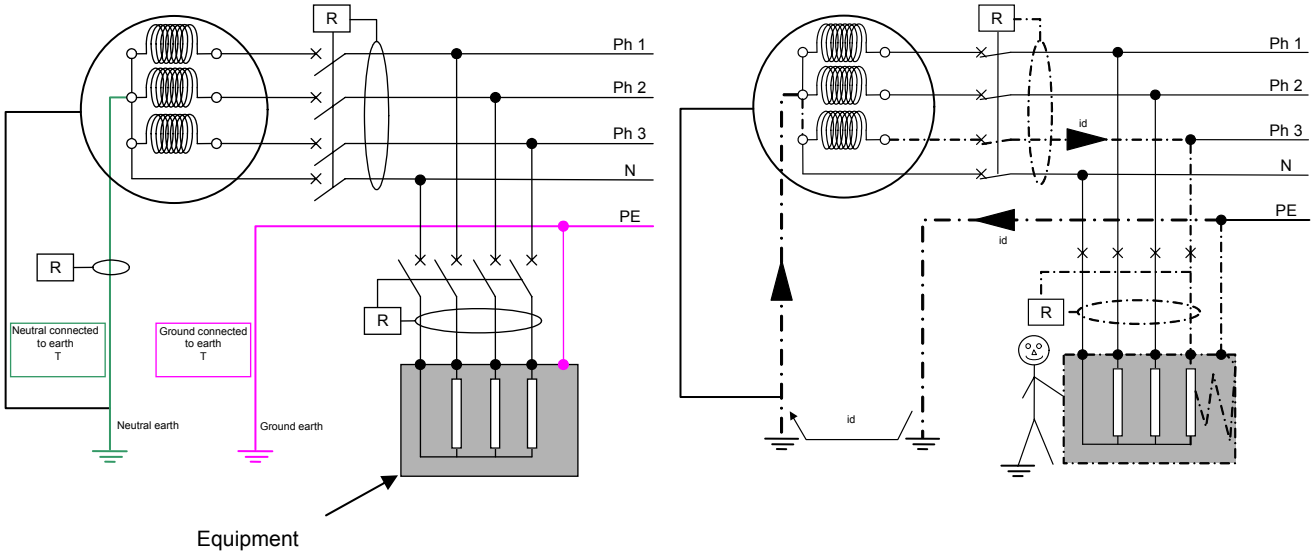


Figure 15 : TT earthing system

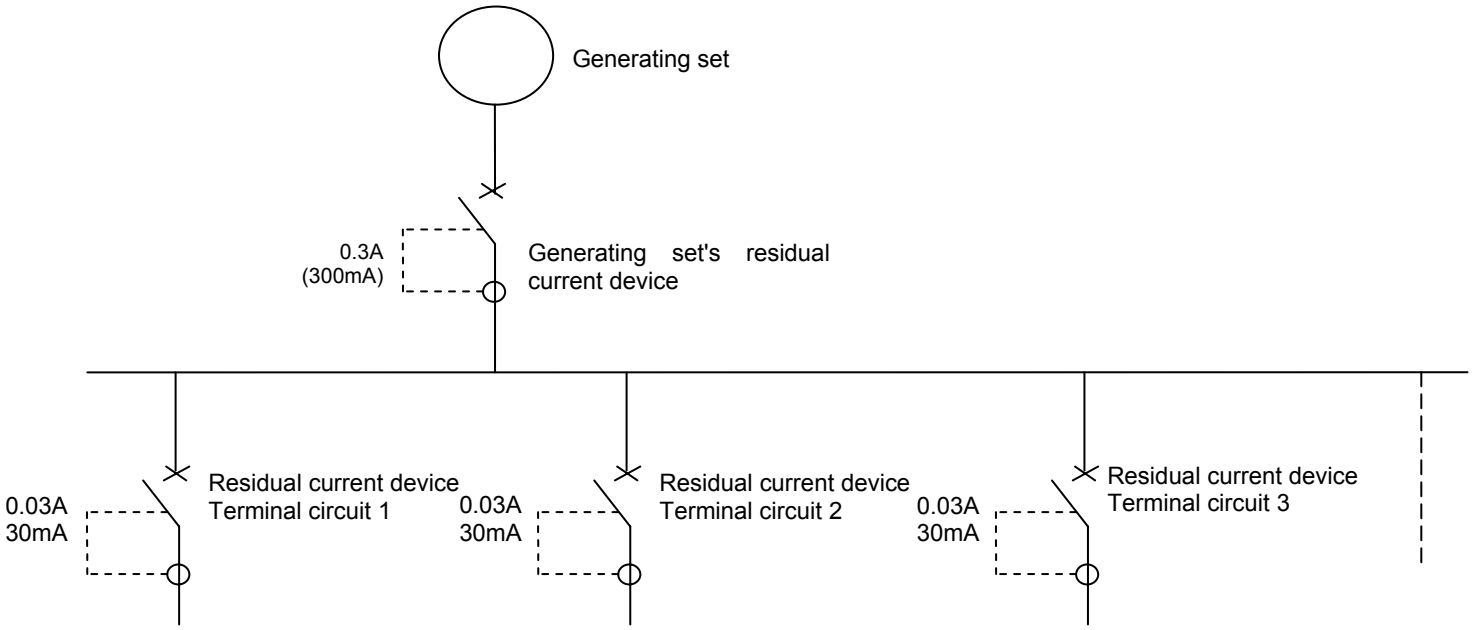
The alternator neutral is earthed, the grounds of the user equipment have their own earth connection.

4.2.2.3. Installing the differential protection

The generating set is equipped with a residual current device in order to guarantee individuals are protected from electric shocks with the TT system. This may be fixed ("vigi" unit) or adjustable (Resys) depending on the option chosen.

- If the generating set's residual current device is fixed and the activation threshold is set to 30 mA, it is guaranteed to protect people.
- If the generating set's residual current device is fixed and the activation threshold has been set at 300 mA, a 30mA residual current device must be added to each of the circuit outlets in use.
- If the generating set's residual current device is adjustable, (located upstream) this must be above those devices located downstream (terminal circuits); this means that continuity on clean circuits will be maintained in the event of a fault on one of the terminal circuits (see the following point on setting the residual current device).

Example:



	Risk of electric shock. The generating set's differential relay is factory-set with a current threshold of 0.03 A (30 mA) and with an automatic time delay (0 s). Any change to the setting on the residual current device could pose a risk to personal safety. The user will be held liable - any changes must only be made by trained, qualified engineers. If the setting is modified, it is essential to restore the original settings after use.

4.2.2.4. Setting the generating set differential protection

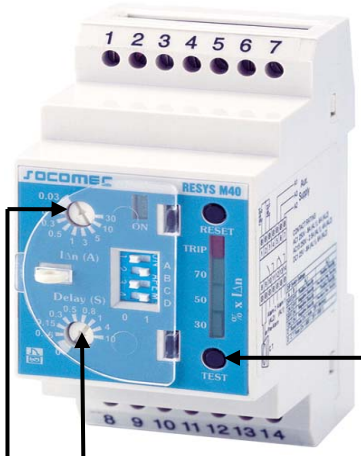
The setting of the generating set's residual current device is guaranteed by a differential relay fitted near the control unit (type A / AC or B depending on the generating sets). As a result, two parameters relating to the downstream device (terminal circuit) must be set:

- Current threshold: the generating set's differential relay must be three times more sensitive than that of the terminal circuit.
- Time delay: the cut-off of the generating set's differential relay must be longer than that of the terminal circuit.

- **Type A / AC differential relay**:
  - Use:
    Differential relay for which operation is guaranteed:
    - for residual sinusoidal alternating currents;
    - for continuous pulsed residual currents;
    - for continuous pulsed residual currents with a continuous component of 0.006 A with or without phase check, independent of the polarity.

  - Setting:

1. Use a screwdriver to set the current threshold potentiometer (1) to 0.03 A (30 mA).
2. Use a screwdriver to set the time delay potentiometer (2) to 0s (automatic).
3. Test the residual current device using the "Test" button on the relay (3).



Test Button (3)

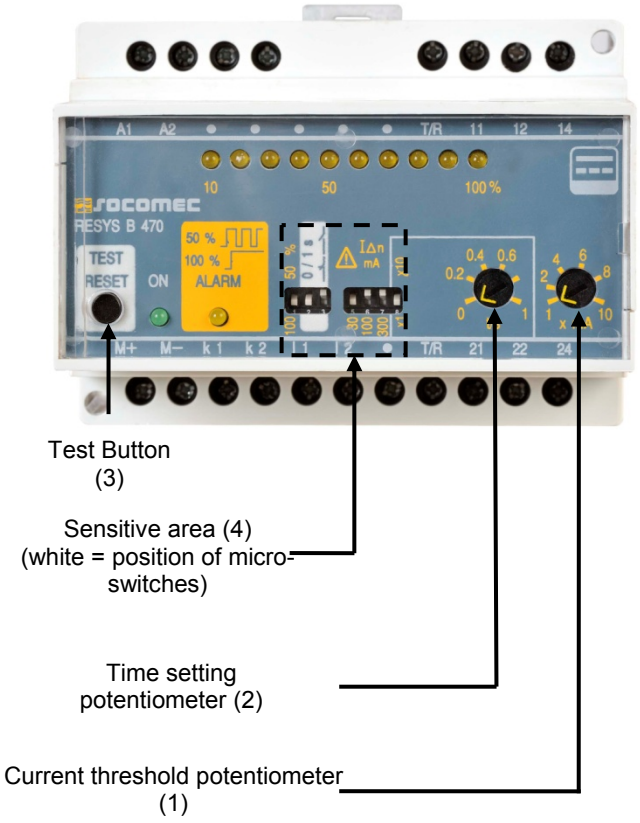
Time setting potentiometer (2)

Current threshold potentiometer (1)

- **Type B differential relay:**
  - ➢ Use:
    Differential relay for which operation is guaranteed:
    - as in the case of type A;
    - for residual sinusoidal currents up to 1000 Hz;
    - for residual sinusoidal currents superimposed on a pure continuous current;
    - for continuous pulsed currents superimposed on a pure continuous current;
    - for residual currents which could come from rectifier circuits i.e.:- three phase half-wave rectifier or a three-phase full-wave bridge rectifier, full-wave bridge rectifier between phases, with or without phase angle check, independent of the polarity.

  - ➢ Setting:

1. Use a screwdriver to adjust the current threshold using the setting potentiometer (1) and the micro-switches (4) to 0.03 A (30 mA).
2. Use a screwdriver to adjust the time delay using the setting potentiometer (2) and the micro-switches (4) to 0s (automatic).
3. Test the residual current device using the "Test" button on the relay.



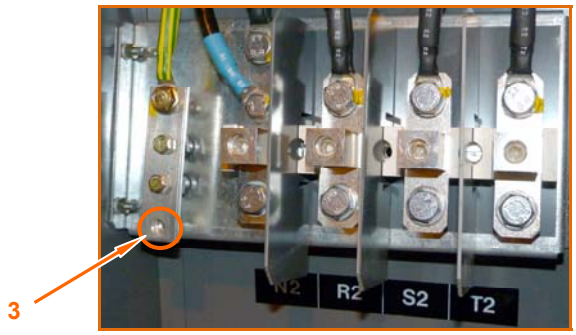
DANGER	**Risk of electric shock**. The generating set's differential relay is factory-set with a current threshold of 0.03 A (30 mA) and with an automatic time delay (0 s). Any change to the setting on the residual current device could pose a risk to personal safety. The user will be held liable - any changes must only be made by trained, qualified engineers. If the setting is modified, it is essential to restore the original settings after use.

4.2.2.5. Earthing the generating set

⚠	**RISK OF ELECTRIC SHOCK.** **Before use, the generating set must always be earthed. Protection against electric shocks is only effective once the earthing connection has been made.** **Disconnect the battery leads, starting with the negative lead (-), or use the battery isolating switch before carrying out any operations on the generating set.**
DANGER	

1. Open the door to the power section (no.1) then the access door to the cable router flap and to the connection terminal box (no.2).

2. Connect the earth cable (supplied) to the terminal (rep.3) on the generating set located on the connection terminal box.

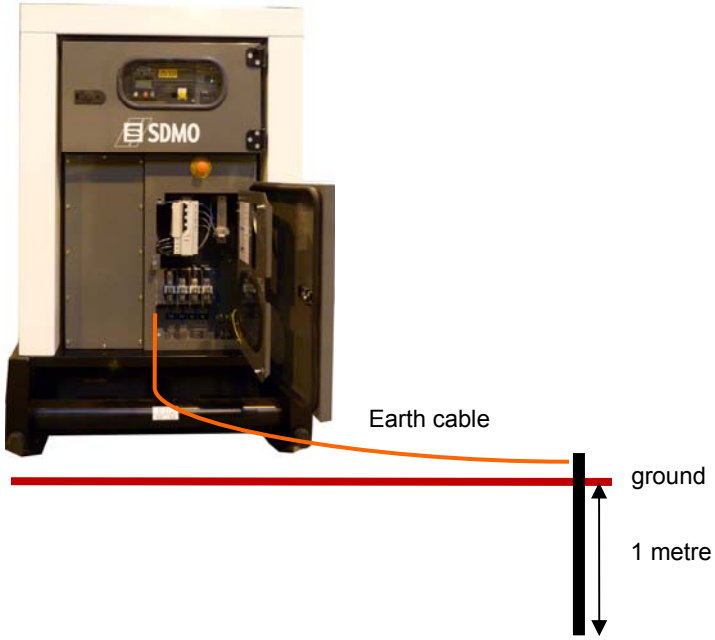


3. Check the length of the earthing rod depending on the nature of the ground and adapt if necessary.

IMPORTANT	The equipment supplied is not suitable for bare stony soils, dry sand or impermeable rock.

Nature of ground	Length of earthing rod (in metres)
Thick arable land, damp compact backfill	1
Thin arable land, gravel, rough backfill	1
Bare stony soils, dry sand, impermeable rock	4 or 4 x 1

4. Plant the earthing rod in the ground and connect it to the earth cable.



Note: For the United States (National Electrical Code ref. NFPA-70), use a copper wire with a minimum cross-section of 13.3 mm² (or AWG 6 at most) connected to the generating set's earth connection and a galvanised steel earthing rod completely buried in the ground in an upright position. This earthing rod must be at least 2.5 m long (of which at least 1 m must be in the ground).

4.2.3 Making the connections

4.2.3.1. Connections - general information

When connecting, always comply with standard NFC 15-100 and the application guide NFC 15-401 (in France) or follow standards based on the international standard IEC 60364 (countries outside France).
The cable cross-section and number of connection cables should be determined according to the type of connection cable and the current standards to be observed in the country of installation. The choice of connection cables must comply with international standard IEC 60364-5-52.

4.2.3.2. Selecting the power cables

The calculation rules used to choose the power connection cable size are defined below:

- Identify the current shown on the generating set's identification plate.
- From the table below, select the circuit breaker rating directly above the current shown on the generating set's identification plate.
- Choose the corresponding cable size.

.

Three-phase
Permitted drop in voltage = 5% / Multi-core conductors or connected single-core conductors where rating = 4X…(1) / Cable type PVC 70°C (e.g. H07RNF) / Ambient temperature = 30°C.

Circuit breaker rating (A)	Cable sizes		
	0 - 50m	51 - 100m	101 - 150m
	mm²/AWG*	mm²/AWG*	mm²/AWG*
10	1.5 / 14	2.5 / 12	4 / 10
16	2.5 / 12	4 / 10	6 / 9
20	2.5 / 12	4 / 10	6 / 9
25	4 / 10	6 / 9	10 / 7
32	6 / 9	6 / 9	10 / 7
40	10 / 7	10 / 7	16 / 5
50	10 / 7	10 / 7	16 / 5
63	16 / 5	16 / 5	25 / 3
80	25 / 3	25 / 3	35 / 2
100	35 / 2	35 / 2	4X(1X50) / 0
125	(1) 4X(1X50) / 0	4X(1X50) / 0	4X(1X70) / 2/0
160	(1) 4X(1X70) / 2/0	4X(1X70) / 2/0	4X(1X95) / 4/0
250	(1) 4X(1X95) / 4/0	4X(1X150) / 2350MCM	4X(1X150) / 2350MCM
400	(1) 4X(1X185) / 0400MCM	4X(1X185) / 0400MCM	4X(1X185) / 0400MCM
630	(1) 4X(2X1X150) / 2x 2350MCM	4X(2X1X150) / 2x 2350MCM	4X(2X1X150) / 2x 2350MCM

Single phase
Permitted drop in voltage = 5% / Multi-core conductors / Cable type PVC 70°C (e.g. H07RNF) / Ambient temperature =30°C.

Circuit breaker rating (A)	Cable sizes		
	0 - 50m	51 - 100m	101 - 150m
	mm²/AWG*	mm²/AWG*	mm²/AWG*
10	4 / 10	10 / 7	10 / 7
16	6 / 9	10 / 7	16 / 5
20	10 / 7	16 / 5	25 / 3
25	10 / 7	16 / 5	25 / 3
32	10 / 7	25 / 3	35 / 2
40	16 / 5	35 / 2	50 / 0
50	16 / 5	35 / 2	50 / 0
63	25 / 3	50 / 0	70 / 2/0
80	35 / 2	50 / 0	95 / 4/0
100	35 / 2	70 / 2/0	95 / 4/0
125	50 / 0	95 / 4/0	120 / 2250MCM

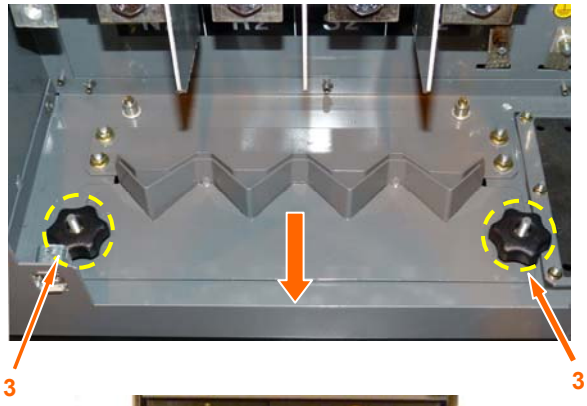
** : AWG. American Wire Gauge, American standard for electrical cables.*

4.2.3.3. Connecting the generating set to the installation

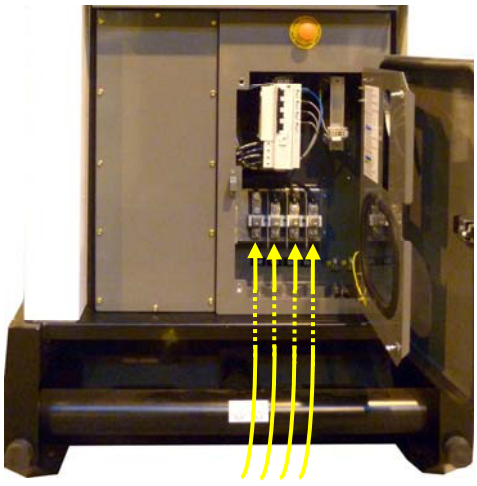
⚠ DANGER	**RISK OF ELECTRIC SHOCK.** **Before use, the generating set must always be earthed. Protection against electric shocks is only effective once the earthing connection has been made.** **Disconnect the battery leads, starting with the negative lead (-), or use the battery isolating switch before carrying out any operations on the generating set.**

1. Open the door to the power section (no.1) then the access door to the power connection cable router flap and to the connection terminal box (no.2).

2. Loosen the two knobs (no.3) on either side of the power connection cable router flap then slide the flap towards the outside of the generating set.

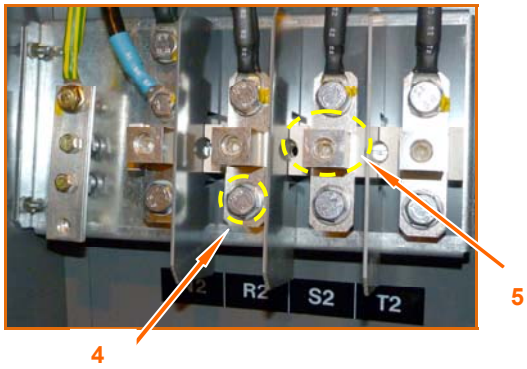


3. Feed the power connection cables through the cable router flap.

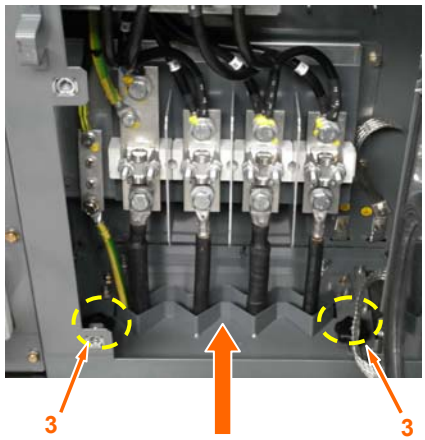


Power cables

4. Connect the power connection cables onto the bars (N/L0-L1-L2-L3 or N2-R2-S2-T2) using the terminals (no.4) or clamps (no.5).

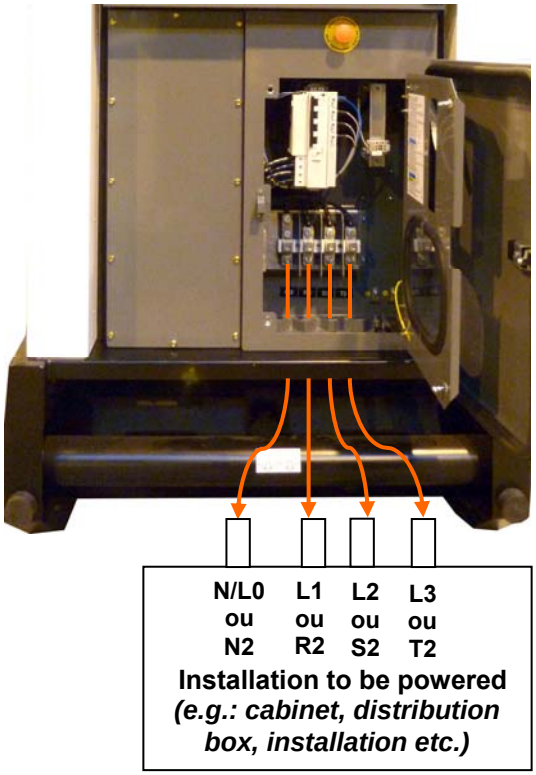


5. Slide the cable router flap towards the inside of the generating set until it makes contact with the power connection cables then retighten the two knobs; close the access door to the power section back up again.



6. Connect the power connection cables to the installation to be powered ensuring the live and neutral wires are correctly connected.

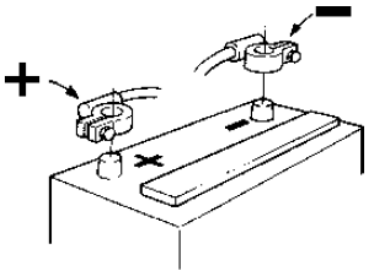
IMPORTANT	Our generating sets are factory-set with a conventional direction of phase rotation. A phase converter (not supplied) can be used to ensure correspondence of phases between the generating set and the installation..



IMPORTANT	To limit the risk of falls caused by obstacles on the floor, it is recommended to suspend cables and ventilation ducts. As necessary, ensure that cables which remain on the floor are protected by burying or covering them.

4.2.3.4. Connecting the battery or batteries to the generating set

IMPORTANT	Always ensure that the polarities of the battery and starter motor correspond. Never swap the positive and negative battery terminals when connecting them. This could cause severe damage to the electrical equipment.



To connect the battery:
1. Connect the red connecting cable (+) to the positive battery terminal.
2. Then connect the black cable (-) to the negative battery terminal.

To disconnect the battery:
1. First disconnect the black cable (-)
2. Then disconnect the red cable (+).

4.2.4 Overvoltage

Generating sets are not equipped with devices that protect against voltage surges from atmospheric discharges or due to handling operations.

The company disclaims all liability for any accidents caused by these phenomena.

However, it is possible to install surge protectors considering that this assembly does not provide complete protection.

5. Installation

5.1. Warnings concerning commissioning

IMPORTANT	The inspections referred to in this section enable the electrical generator set to operate. Specific skills are required to carry out these operations. **They must only be entrusted to personnel with the necessary skills.** **Failure to follow these instructions in any way could result in malfunction or very serious accidents**.

5.2. Checking the generating set installation

- Check the position of the generating set (stability, mounting, available space, ventilation, exhaust, etc.).
- Check the electrical connections :
  - earthing;
  - electrical control connections;
  - electrical power connections;
  - starter battery charging system (rating and voltage) if fitted to the generating set.

5.3. Preparing for operation of the generating set

- Become familiar with the controls useful to operate the generating set.
- Read and understand the "user" menus of the control unit.
- Become familiar with the maintenance plans for the generating set .
- Become familiar with the operation of the generating set at no load or under load.
- Become familiar with the fluid specifications (fuel, lubricant and coolant).

5.4. Checking the generating set before startup

- Check that the plugs, blanking covers and protective adhesive strips have been removed.
- Ensure that the anti-humidity bags have been removed from the electrical sections (cabinet or control console, alternator, etc.).
- Check the insulation of the alternator *see the alternator's maintenance manual.*
- Check the levels *see the engine's maintenance manual:*
  - coolant;
  - oil;
  - fuel.
- Open the oil filler tap (if fitted to the generating set).
- Check the starter battery or batteries (connecting and charge) *see the paragraph entitled "Starter batteries".*
- Check the starter battery charging system (if fitted to the generating set).

5.5. Checking the generating set after startup

Off-load tests

- Carry out the safety checks (emergency shutdown, oil pressure, coolant temperature, etc.).
- Check the mechanical parameters:
  - engine parameters (oil pressure, coolant temperature);
  - absence of abnormal vibrations;
  - absence of abnormal noises;
  - absence of leaks.
- Check the electrical parameters:
  - voltage, frequency, current;
  - rotating field.

On-load tests

- Check the mechanical parameters:
  - engine parameters (oil pressure, coolant temperature);
  - absence of abnormal vibrations;
  - absence of abnormal noises;
  - absence of leaks.
- Check the electrical parameters:
  - voltage, frequency, current;
  - rotating field.

6. Using the generator set

6.1. Pre-Start Inspection

Inspecting the engine compartment

- Make sure there is no combustible material near the engine or battery. Also, check to make sure that the engine and battery are clean. If combustible materials or dust are found near the engine or battery, remove them.
- Check the electrical wiring for such components as the starter and alternator for looseness
- Check the entire engine for fuel leakage, engine oil or coolant. If leakages are found, repair.
- Make sure the following valves, plugs and cocks are open or closed (tightened) properly:
  - ✓ Fuel feed valve: Open
  - ✓ Coolant drain cock (plug): Closed (Tightened)
  - ✓ Oil drain valve: Closed

Checking the engine oil level

⚠ Important	- **Do not** top up the oil if the oil level is not **below** the low level marker.

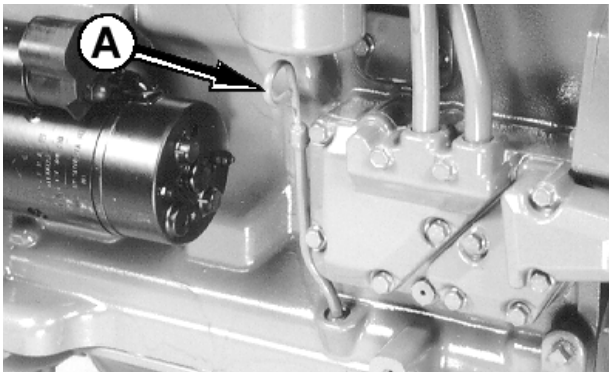
❶ Pull out the oil level gauge (A) and wipe it clean using a waste cloth.

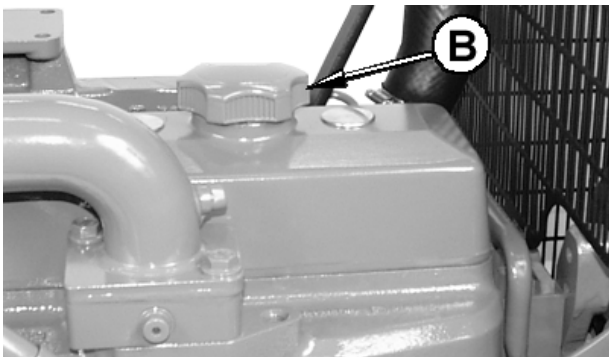
❷ Insert the oil level gauge fully into the oil level gauge guide, then pull out the gauge again.

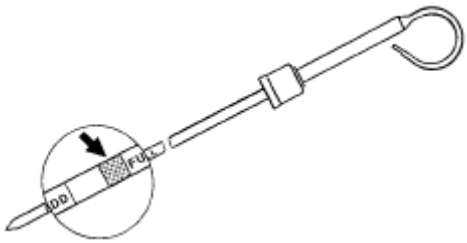
❸ The proper oil level is between the high and low marks on the oil level gauge. If the oil level is low, add engine oil.

❹ Install the oil filler cap (B) after refilling.

❺ Check the oil pan and other area for oil leakage.

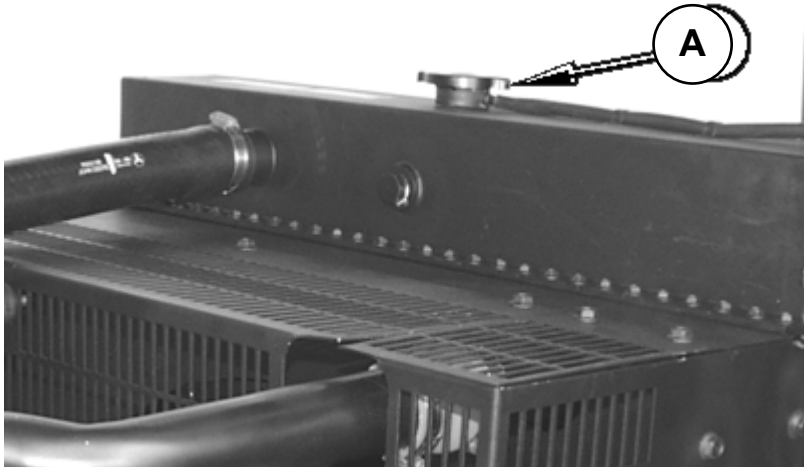






Checking the coolant level

Warning	Remove the radiator filler cap only after the engine has cooled to room temperature. Place a waste cloth over the cap, and loosen the cap about a half-turn or stand the lever to the upright position to release internal pressure. Never open the radiator filler cap while the engine is hot, otherwise the steam or hot coolant spurts out and you may be scald with it.



❶ Open the radiator filler cap (A).
❷ Check coolant level which should be at bottom of filler neck, add coolant to the speci-fied level.
❸ Check for leaks in the cooling circuit.

Checking the air filter

Important	A clogged filter element limits the engine's air intake and a reduced air supply to the engine.

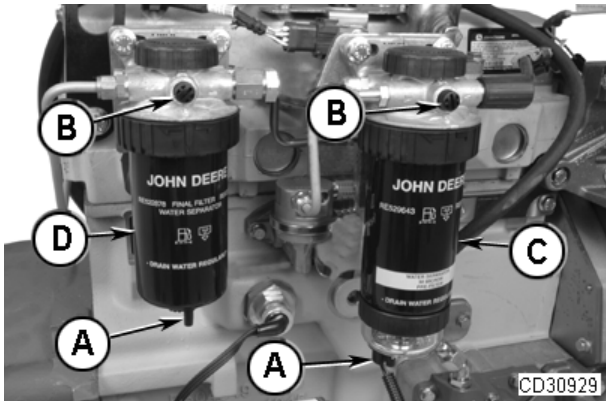
If the air filter is fitted with a dust control valve (A), press the tip of the valve to evacuate any accumulated dust particles.

Check the air filter clogging indicator (B). If the indicator is red, clean the air filter.

Checking the fuel filters

Danger	**When handling fuel, make sure there are no open flames or other fire hazards near the engine. Wipe off any spilled fuel completely.Spilled fuel can ignite and cause a fire.** **The fuel prefilter draining should not be performed when the engine is cold and stopped.**

1. Loosen drain plugs (A) at bottom of fuel filters two or three turns.
2. Loosen air bleed plugs (B) two full turns and drain water into a suitable container.
3. When fuel starts to drain out, tighten drain plugs securely.
4. Bleed fuel system.



A - Drain plug
B - Air bleed plug
C - Primary fuel filter
D - Final fuel filter

6.2. Generator set with NEXYS control panel

6.2.1 Control panel presentation

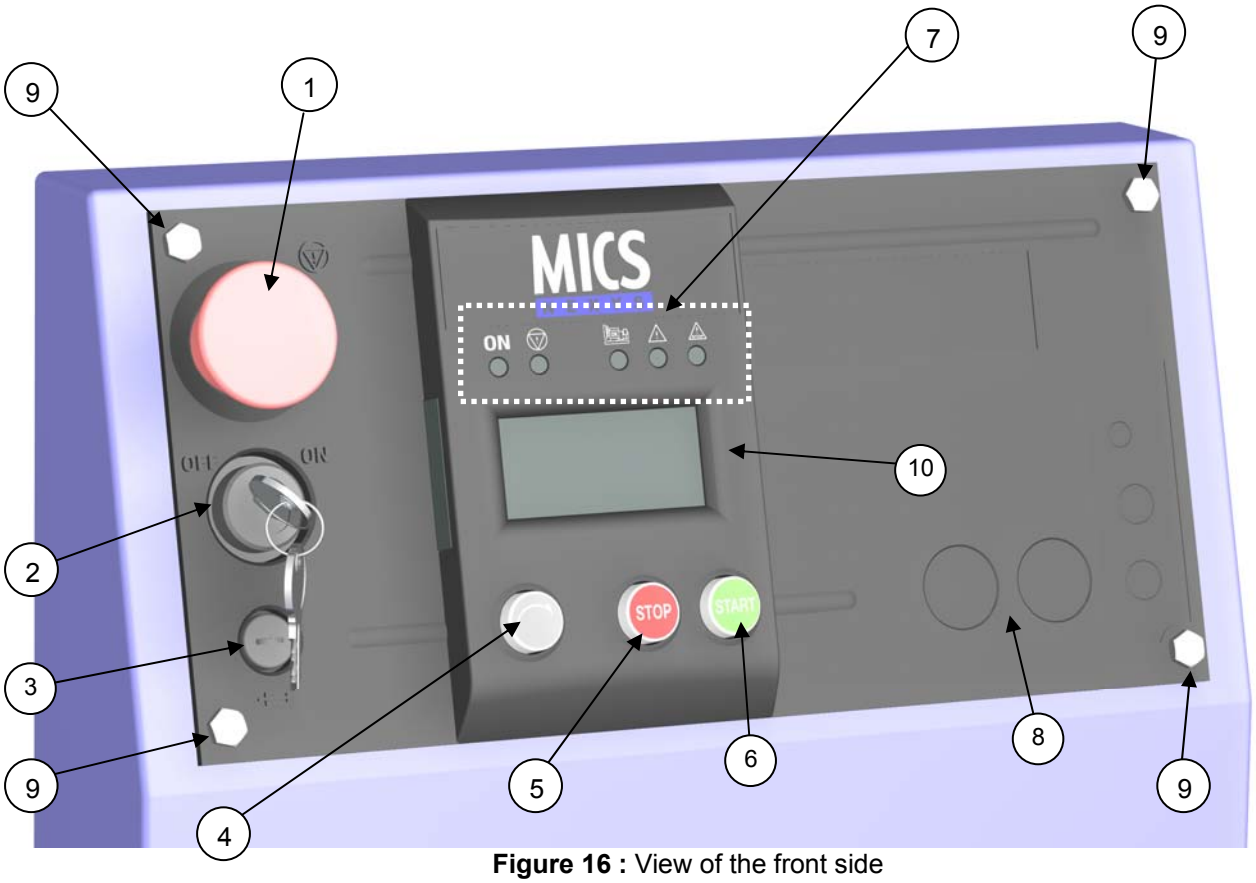


Figure 16 : View of the front side

① Emergency stop button for switching off the generating set in the event of a fault which could endanger personnel or damage equipment

② Key switch for starting up/shutting down the module and RESET function

③ Electronic card protection fuse

④ Screen-scroll button, press successively to access the various screens which are available

⑤ STOP button, press to switch off the generating set

⑥ START button, press to switch on the generating set

⑦ Normal operation LEDs and alarm and fault warning LEDs

⑧ Slot reserved for panel fascia options

⑨ Mounting bolt.

⑩ LCD for displaying alarms and faults, operating states, electrical and mechanical quantities

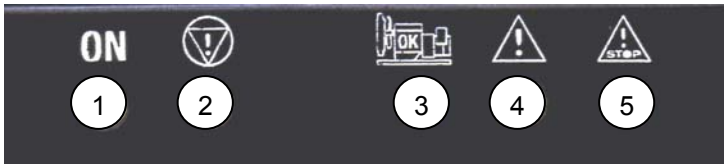


Figure 17 : Description of the LEDs

A lit LED indicates:

① Module being supplied (green, lights up and remains lit)

② Emergency stop activated (control panel or external emergency stop) (red, lights up and remains lit)

③ Visualisation of starting phase and speed/voltage stabilisation (flashing) and generating set operating OK or set ready to generate (green, lights up and remains lit)

④ General alarm (orange, flashing)

⑤ General fault (red, flashing).

6.2.1.1. Introduction to pictograms

The pictograms are as follows:

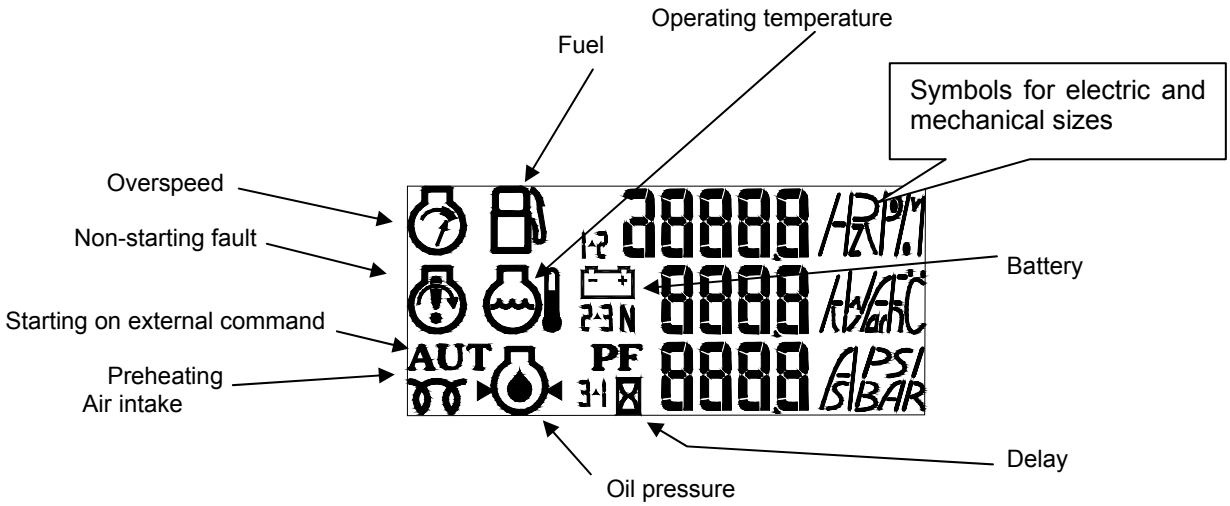


Figure 18 : View of pictograms

- The "fuel level" pictogram is used to display the fault, the alarm and the fuel level.
- The "operating temperature" and "oil pressure" pictograms are used to display the fault and analog value
- The "overspeed" and "non-starting fault" pictograms are used to display the fault.
- The "battery" pictogram is used to display the "alternator charge" fault and to indicate the battery voltage.

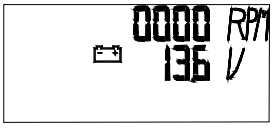
6.2.2 Manual starting

Danger	Check that the generating set circuit breaker has triggered.

❶ connect the generating set battery.

❷ turn the key switch to the ON position (without forcing it)

- ✓ All of the LEDs light up for 2 seconds, to confirm that they are operating correctly.
- ✓ If the LEDs do not light up, check the protection fuse and replace it if necessary.
- ✓ All the items on the screen are displayed for 2 seconds.
- ✓ Only the "ON" LED remains lit to indicate that the module is powered up.
- ✓ The following screen appears.

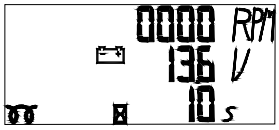


The first line displays the motor speed in RPM.
The second line displays the battery voltage in volts (V).

- ✓ Check the battery voltage (min. 12 V)

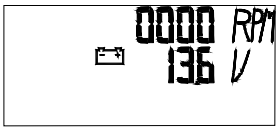
❸ Press (once briefly) the green "START" button.

- ✓ If the motor is equipped with an air preheating system, there is a 10-second delay before the motor starts (preheating activation period).
- ✓ The following screen appears



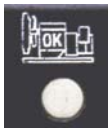
The third line displays the air preheating time remaining (with pictograms representing a resistor and an hourglass).

- ✓ If the motor is not fitted with an air preheating system or once the preheating delay has elapsed, the engine starts up (start of a cycle comprising 3 attempts to start up the engine).
- ✓ The following screen appears.



Warning	The number of successive and automatic starting attempts is limited to 3.

Note: the LED flashes as soon as the START button is pressed and continues to flash until the frequency stabilises if a "measurements" card has not been inserted and until the frequency and voltage stabilise if a "measurements" card has been inserted.

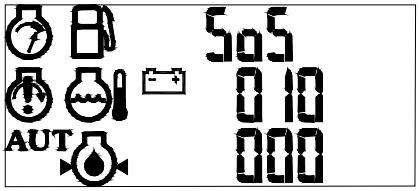
Following stabilisation, the LED light comes on continuously. 

6.2.3 Switching off

❶ trigger the circuit breaker located at the base of the centre console
❷ Let the motor run under no load for 1 to 2 minutes to allow it to cool.
❸ press the "STOP" button to stop the generating set.
❹ switch off the MICS Nexys module by switching the key to "OFF" (without forcing it).

6.2.4 Alarms and faults

The appearance of a fault or an alarm causes the following screen to be displayed (one or more pictograms or a fault code along with the SOS message are displayed).

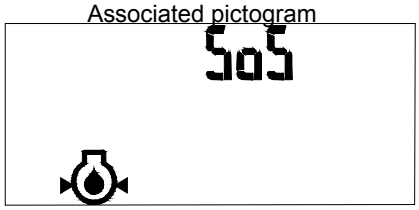
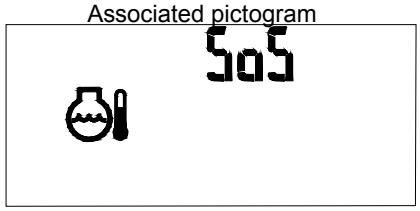
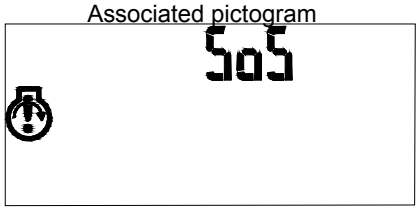
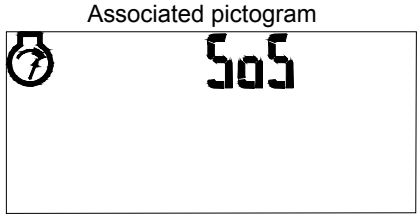
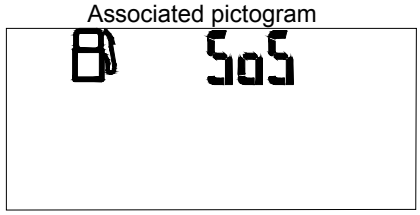


The user can access the following screens by pressing the key

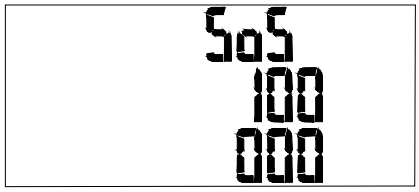
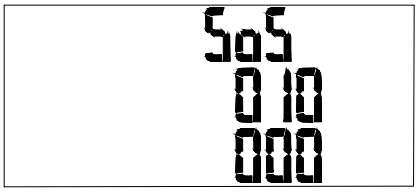
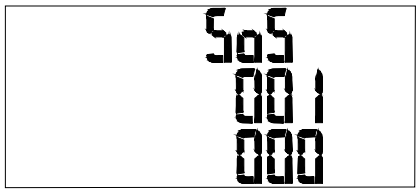
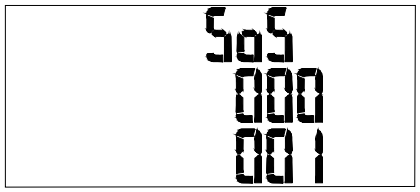
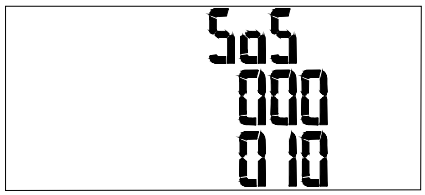
The fault or alarm screen will disappear once the fault or alarm has been removed.
Only one fault is displayed on this screen (the fault which caused the generating set to stop).
If one or more faults have appeared after the first fault, they can only be displayed after the first fault has been reset (press "Reset" as many times as the number of faults present).
Note: an alarm can appear at the same time as a fault.

6.2.5 Faults and alarms - Details

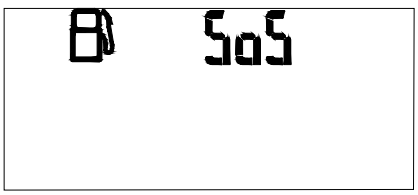
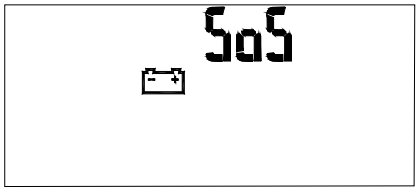
List of faults which will cause the generating set to stop and generate a pictogram

Oil pressure fault: Indicates that the oil pressure is incorrect	Associated pictogram 
Engine temperature fault: Indicates that the engine temperature is too high.	Associated pictogram 
Non-starting fault: Indicates that there have been three consecutive unsuccessful starting attempts.	Associated pictogram 
Overspeed fault: Indicates an excessive generating set running speed.	Associated pictogram 
Low fuel level fault: Indicates the need to top up the fuel.	Associated pictogram 

List of faults which will cause the generating set to stop and generate a fault code

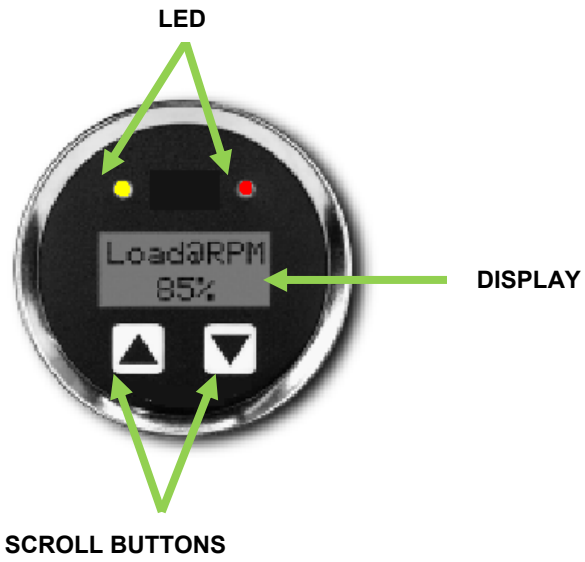
Low coolant level fault: indicates that the level of coolant is low in the radiator (linked to a two second time delay). Or Overload or short-circuit fault (optional): with the circuit breaker SD contact closing (overload or short-circuit), the generating set switches off immediately also causing the main circuit breaker to be triggered.	Associated message 
Additional fault linked to message opposite: is displayed in the following two cases: ➢ Differential fault (1) ➢ insulation fault (2) (1) Differential fault (optional): with a differential fault causing the activation of the differential relay, the generating set stops immediately also causing the main circuit breaker to be tripped. (2) Insulation fault (optional): with an insulation fault causing the activation of the control unit performing insulation, the generating set stops immediately.	Associated message 
Underspeed fault: indicates an incorrect rotation speed (below 1000 rpm).	Associated message 
Emergency stop or external emergency stop fault	Associated message 
"STOP" fault activated if the "STOP" button is pressed whilst the "AUT" LED is flashing to indicate that the generating set is operating in automatic mode.	Associated message 

List of alarms associated with a pictogram

Low fuel level alarm: Indicates the need to fill up with fuel.	Associated pictogram 
"Alternator charging fault" alarm indicates a problem affecting the alternator charging rate.	Associated pictogram 

6.2.6 MURPHY diagnostic module

The fault finding module (MDDM) is an indicator for analysis and fault finding designed and manufactured for reading information available on the J1939 CAN Bus. The fault finding module is easy to use and will enable you to view the values of the various engine parameters and engine operating status codes.
It shows two lines, each of 8 characters, on a backlit LCD display. Two scroll buttons enable you to navigate in the menus and parameters. Two LEDs, one red and one orange, indicate the fault or alarm status of the engine or ECU.



A- <u>Machine Parameters</u>

The following parameters are available on the Murphy fault finding module:
- working hours counter
- engine speed
- battery voltage
- engine speed
- coolant temperature
- oil pressure
- fuel economy
- air manifold temperature
- actual consumption
- active status codes
- status codes recorded coming from the engine
- MDDM20 parameter configuration for display
- display of the engine configuration parameters

-etc. depending on the type of engine.

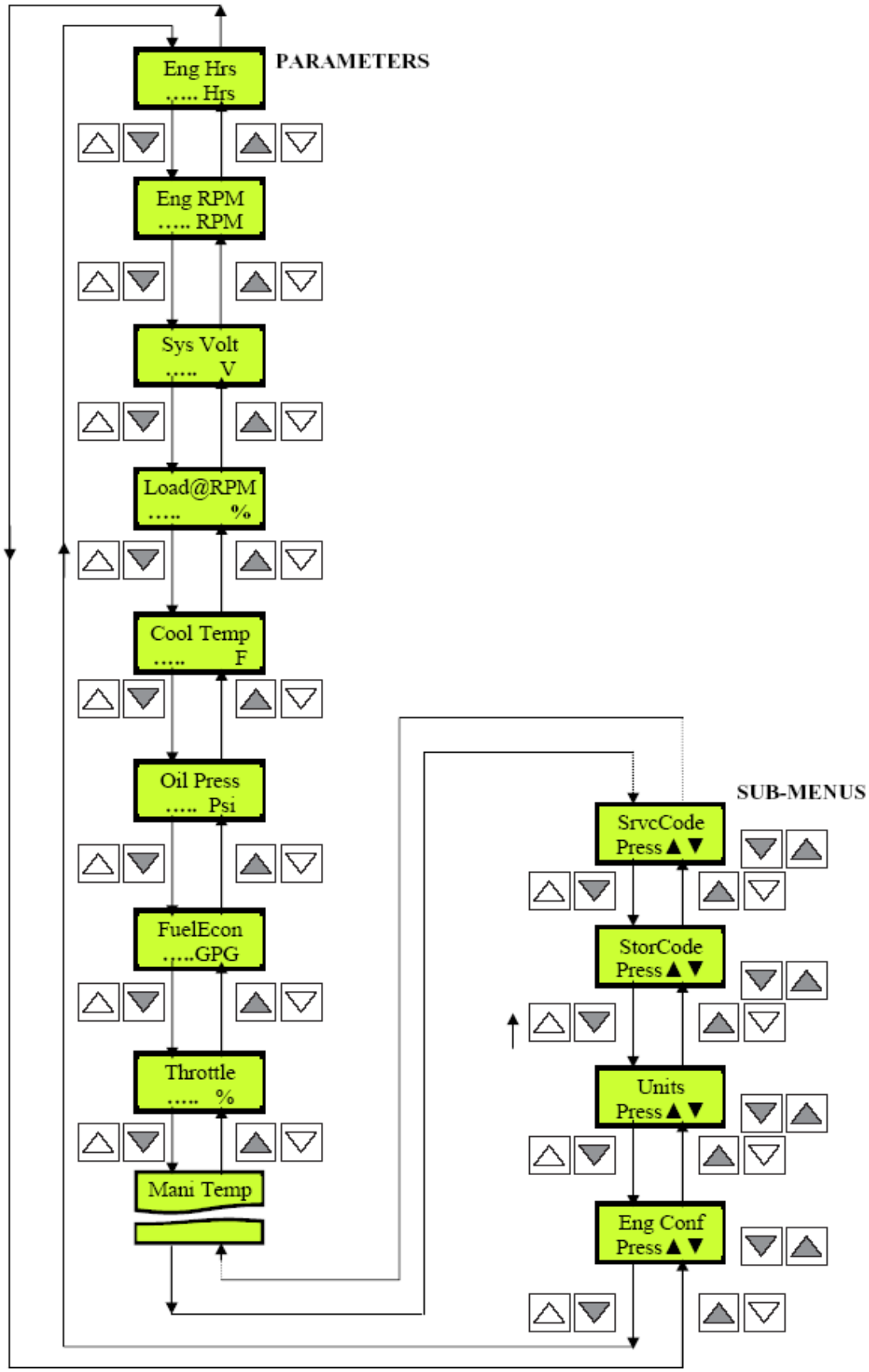
B-<u>Use</u>

The Murphy module (MDDM) offers simple menu navigation:

1.To browse the list of parameters, press the Up and Down buttons.

2.To enter or exit a sub-menu, press both arrows simultaneously.

The following diagram shows the structure of the main menu and how to go to each parameter:



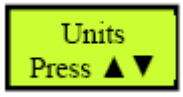
The Parameter menu: to navigate in this menu simply use the arrow buttons separately.

The sub-menus: The sub-menus are available at the end of the parameter menu. To go to these sub-menus, scroll through the parameters using the ▲ and ▼ buttons until you reach the required sub-menu.

C- <u>The Sub-menus.</u>

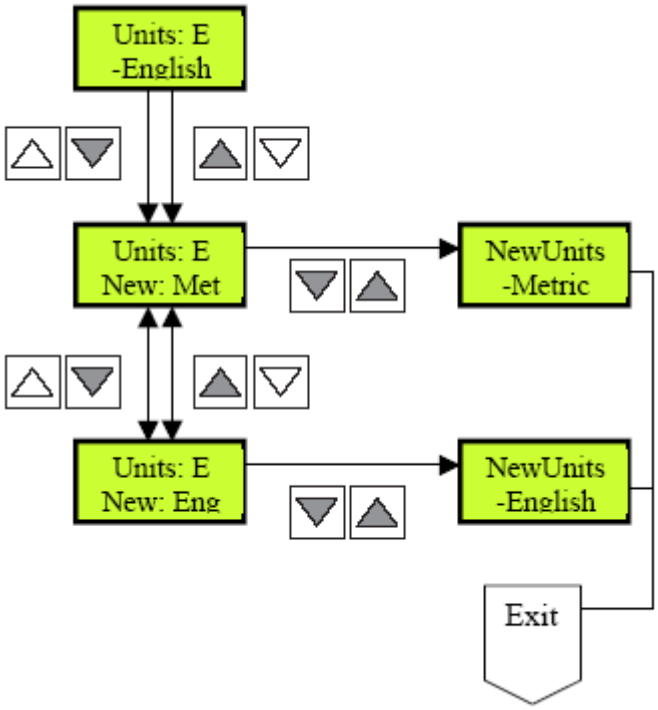
The sub-menus enable certain aspects of the fault finding module display to be modified.

<u>Changing the unit of measurement:</u>
There are two display modes available for units: English or metric. To change your units of measurement, use the ▲ and ▼ scroll buttons until you get to the sub-menu:



Press the ▲ and ▼ arrows simultaneously if you want to retain the current designation.

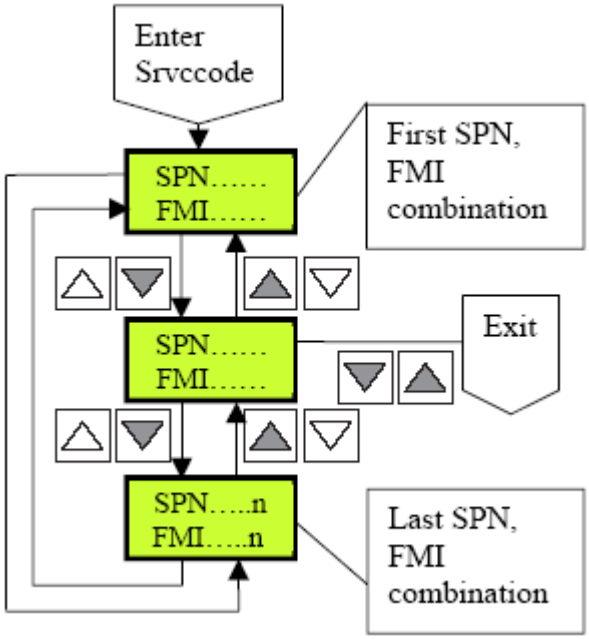
Press one of the scroll buttons to show the second mode for displaying units. If you want to retain the second display mode, confirm this by pressing the ▲ and ▼ buttons simultaneously.



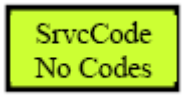
D-Displaying the active service codes:

The fault finding module enables the machine faults and alarms to be displayed in real time. When a fault appears, the display shows the message "SrvcCode" every five seconds between displaying the current parameters.

The orange LED will light up when an alarm code is displayed (engine does not stop), the red LED will light up when a fault code is displayed.
SPN and FMI codes are used in standard J1939 to identify faulty equipment
SPN: Suspect Parameter Number.
FMI: Failure Mode Indicator.



In the event that there are no active fault codes, the following screen will appear:



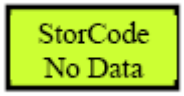
Depending on the SPN/FMI code, refer to the attached "List of engine fault codes" and "Engine user and maintenance manual" for help on fault finding and maintenance.
Note that the manufacturer documents do not always stipulate the SPN used, for example:
-Volvo uses a set of codes called PID (Parameter Identifier) or SID (System Identifier); these two names relate to standards J1587 or J1979, but in the case of VOLVO engines they relate to standard J1587. These two codes find their equivalent in standard J1939 (SPN). The attached "List of engine fault codes" indicates the SPN equivalent to Volvo's SID and PID.
- John DEERE complies with standard J1939 and uses SPN codes.

E-display of machine codes programmed:

The MDDM can display the codes of services programmed in the ECU memory. These programmed service codes are useful for generating set fault finding and maintenance.

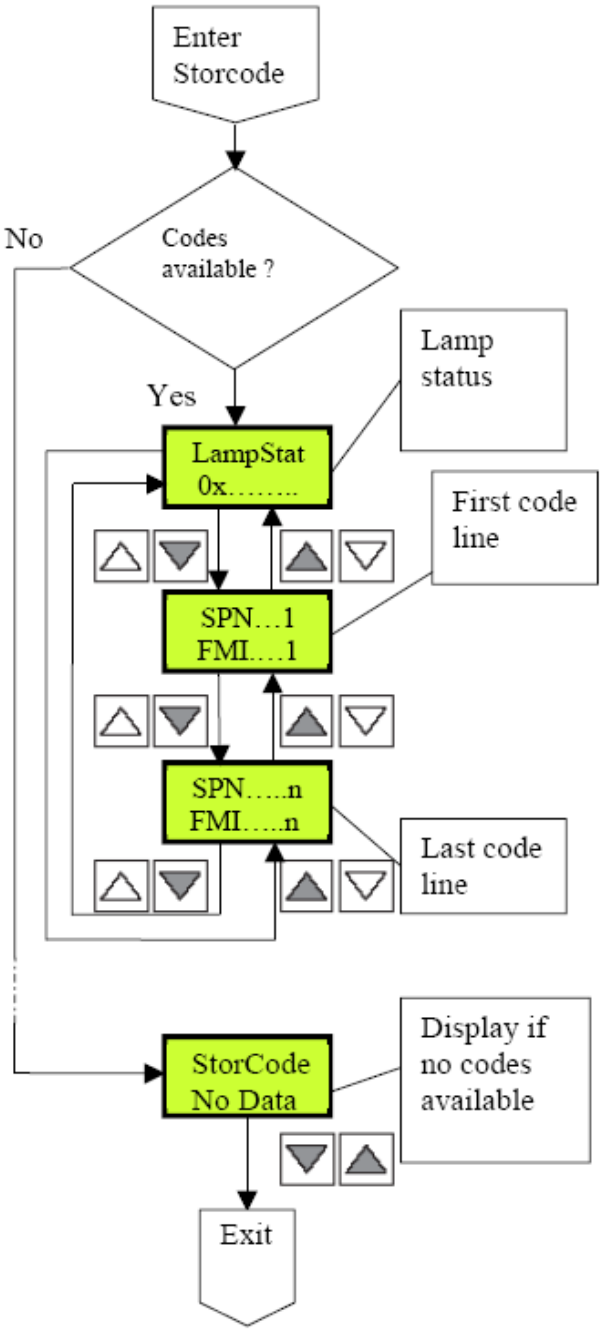
To display the programmed codes, scroll through the parameters until you reach the following sub-menus:

In the event that there are no programmed codes to display, the following screen will appear:



The purpose of programmed codes is to create a fault log, which is used to determine recurrent faults and thereby carry out effective corrective and preventive maintenance on the engine; also it not desirable to delete these when the generating set is in operation onsite. Note that at the test bench outlets the EEPROM memory, in which the programmed codes are stored, is reset to zero.

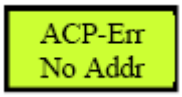
The following diagram shows the structure of the STORCODE (programmed code) menu and how to go to each parameter:



F)-Fault finding module internal errors.
Like any equipment using internal memory and a program, the fault finding module generates fault codes. Two types of code can be recognised:
- Address Claim Procedure Errors
- Run Time Bus Errors.

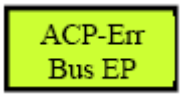
Address Claim Procedure Errors (ACP-Err):
The following fault codes relate to the switching on of the fault finding module.

Error Code 1:



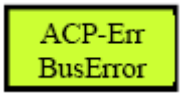
When switched on, the fault finding module must issue a request to the ECU for the network addresses used in order to exploit them; this screen appears when:
- an address cannot be used.
- the fault finding module cannot find the default addresses.
- an address cannot be found in the correct register.

Error Code 2:



Passive Bus Error: this code appears when:
- the fault finding module cannot detect the ECU: in this case the CAN Bus is open.
- the CAN_hi and CAN_lo run time bus connection is reversed between the source (ECU) and the fault finding module.

Error Code 3:



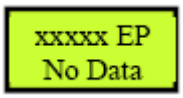
This code is the result of the following problems:
- the CAN_Hi or CAN_lo bus, or both, are connected to an electrical ground or an external source of current.

- data is being not transmitted at a standard baud rate.

This type of fault generally requires repairs to be carried out on the CAN BUS connection and therefore involves work on the engine wiring harness, i.e. on the fault finding module extension.

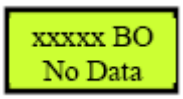
Run Time Bus Errors:
Fault codes can only be active if the fault finding module has been able to obtain the network addresses when it was switched on, see Address Claim Procedure Errors (ACP-err).

Error Code 1:



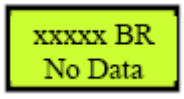
EP=Passive Error, this screen appears when the fault finding module loses contact with the ECU, there may be two causes of this:
- one connector on the bus connection is disconnected.
- the CAN Bus is open.

Error Code 2:



BO=Bus Off, in this case, the case is identical to Error code 3 of the ACP.

Error Code 3:



BR=Bus Reset, this error code is similar to Error code 3 of the ACP, as are its causes. In this case the fault finding module has encountered problems on the CAN Bus and it tries to automatically re-establish the network connection.

6.3. Generator set with TELYS control panel

6.3.1 Control panel presentation

6.3.1.1. View of the front panel

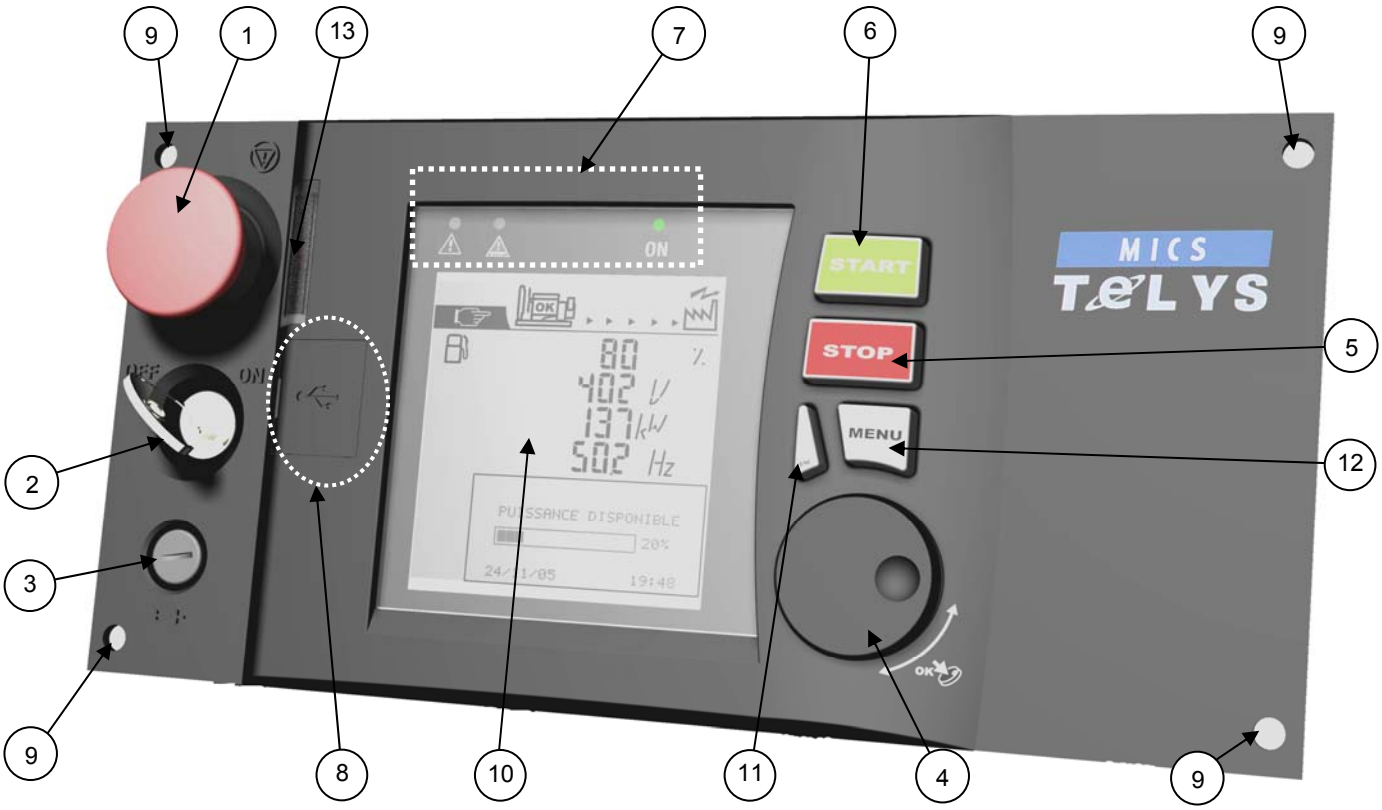


Figure 19 : View of the front panel

1 Emergency stop button (AU) for switching off the generating set in the event of a fault which could endanger personnel or damage equipment.
2 Key switch for switching the module on/off.
3 Electronic board protection fuse.
4 Scrolling and selection wheel for scrolling through the menus and screens and selecting items simply by pressing the wheel.
5 STOP button, press to switch off the generating set.
6 START button, press to switch on the generating set.
7 Power ON LEDs and alarm/fault warning LEDs.
8 Location of USB ports.
9 Mounting bolt.
10 LCD for displaying alarms and faults, operating statuses, electrical and mechanical quantities.
11 ESC button: for returning to the previous selection and for default RESET function.
12 MENU button for accessing the menus.
13 Lighting for the emergency stop button.

Figure 20 : Description of the LEDs

A lit LED indicates:
1 Alarm activated (flashing yellow).
2 Fault found (flashing red).
3 Module on (green, on continuously).

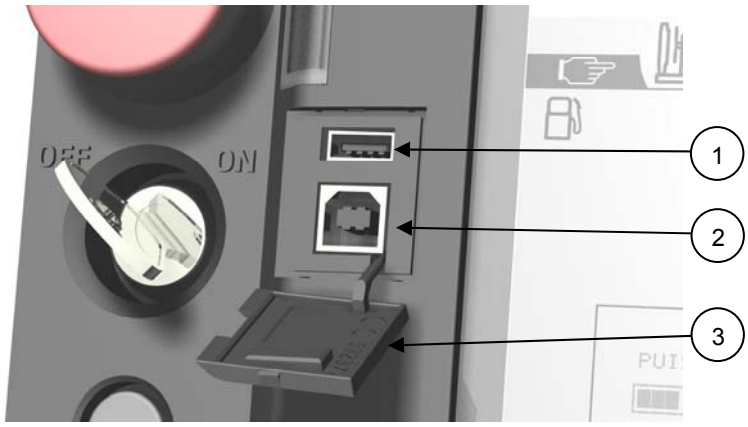


Figure 21 : Close-up of USB ports

1 USB key connection (HOST): file transfer between USB key and TELYS and vice versa.
2 Connection for microcomputer (DEVICE):
- file transfer between PC and TELYS and vice versa,
- main module power supply.

3 Protective cover.

6.3.1.2. Description of the screen

The screen is backlit and requires no contrast adjustments. This screen is divided into 4 zones.

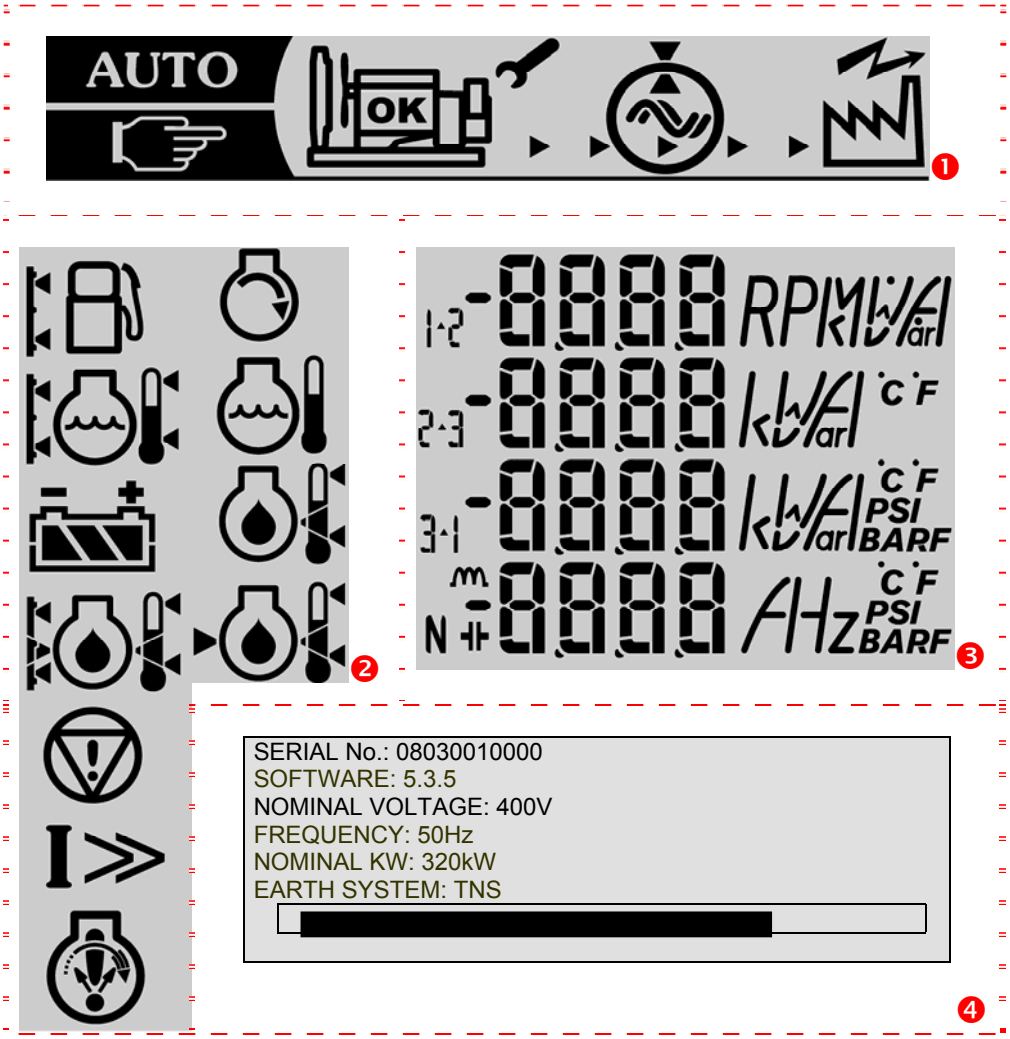


Figure 22 : Description of the screen (example)

❶ Zone 1: in this zone, the status of the generating set is displayed

❷ Zone 2: in this zone, pictograms relating to dimensions measured are displayed, as well as Alarm and Fault pictograms

❸ Zone 3: in this zone, the measured values corresponding to the measured dimensions are displayed with the corresponding units of measurement

❹ Zone 4: in this zone, messages relating to the control of the generating set and the menus are displayed.

Note: the information displayed on measurements, alarms and faults as well as messages and menus relating to control of the generating set will depend on the equipment level of each generating set. Certain screens may therefore not be present.

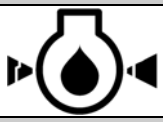
6.3.1.3. Description of the pictograms in zone 1

Zone 1 pictograms

Pictograms	Display	Activation conditions
"MAN" mode	Fixed	TELYS in manual mode (MAN)
	Flashing	For 5 seconds when switching from AUTO to MAN mode
"AUTO" mode	Fixed	TELYS in automatic mode (AUTO)
	Flashing	For 5 seconds when switching from MAN to AUTO mode
	Flashing	Genset starting
	Fixed	Genset started
	Fixed	Genset stabilised (voltage and frequency)
	Flashing (impression of constant movement from left to right)	The genset is generating and in use
	Fixed	Usage supplied
	Not used	
	Fixed	Synchronisation
	Flashing	
	Fixed	Genset synchronised or coupled

6.3.1.4. Description of the pictograms in zone 2

Alarm and fault pictograms in zone 2
All the pictograms in this zone are activated when TELYS is initialised.

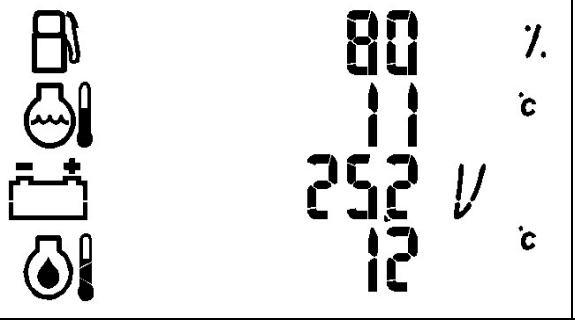
Data displayed			
Fuel level indicator			
Alarm / Fault low fuel level		Alarm / Fault high fuel level	
Coolant level / temperature indicator			
Alarm Low level fault	High level fault alarm	Alarm High temperature fault	No preheating fault alarm
Battery			
Min battery voltage (flashing)	Max battery voltage (flashing)		Battery charge indicator (flashing bars)
Oil pressure / temperature indicator			
Oil pressure Alarm / Fault 	High or low oil level Alarm / Fault	High or low oil temperature Alarm / Fault	
Emergency stop			
Emergency stop fault			
Overload or short circuit			
Tripping of circuit breaker following an overload or short circuit			
Engine speed			
Underspeed fault	Overspeed fault	Non-starting fault	

6.3.1.5. Description of the pictograms in zone 3

Zone 3 pictograms

All the pictograms for these zones are activated when the TELYS is initialised. The pictograms below are shown for information only.

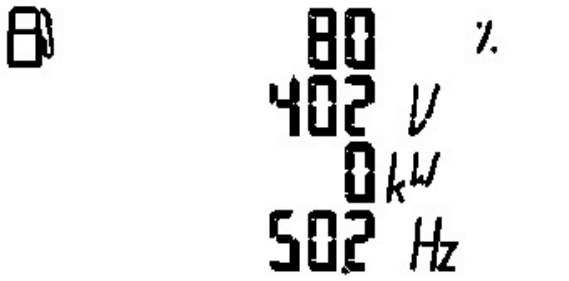
Generating set stopped

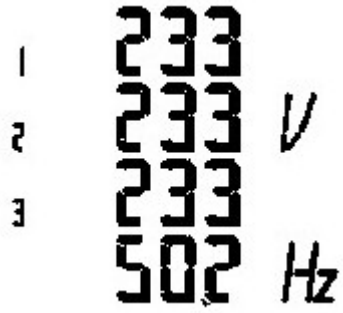
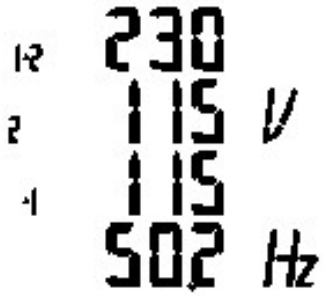
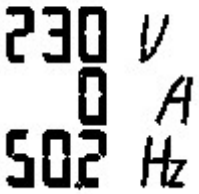
Screen No.	Pictograms	Data displayed
P1		Fuel Level Indication High-temperature (HT) coolant temperature indication (units as per settings menu) Battery Voltage indication Oil Temperature Indication (units as per settings menu)

Genset start-up or genset started or genset stoppage in progress

Screen No.	Pictograms	Data displayed
P2		Engine Speed Indication High-temperature (HT) coolant temperature indication (units as per settings menu) Oil Pressure Indication (units as per settings menu) Oil Temperature Indication (units as per settings menu)

Genset started

Screen No.	Pictograms	Data displayed
P3 Operation default screen		Fuel Level Indication Alternator Compound Voltage Indication Total Active Power Indication Alternator Frequency Indication
P4		Alternator U12 compound Voltage Indication Alternator U23 compound Voltage Indication Alternator U31 compound Voltage Indication Alternator Frequency Indication

Screen No.	Pictograms	Data displayed
P5		Alternator V1 single Voltage Indication Alternator V2 single Voltage Indication Alternator V3 single Voltage Indication Alternator Frequency Indication
P6		Alternator U12 compound Voltage Indication Alternator V2 single Voltage Indication Alternator V1 single Voltage Indication Alternator Frequency Indication
P7		Alternator V1 single Voltage Indication Alternator phase 1 Current Indication Alternator Frequency Indication
P8		Alternator phase 1 Current Indication Alternator phase 2 Current Indication Alternator phase 3 Current Indication Alternator Neutral Current Indication
P9		Total Active Power Indication Total Reactive Power Indication Total Apparent Power Indication Total Output Factor Indication (inductive or capacitive)

Screen No.	Pictograms	Data displayed
P10		Fuel Level Indication Battery Voltage indication Battery Ammeter Indication
P11		Total Reactive Power Indication Alternator U12 compound Voltage Indication Total Active Power Indication Alternator Frequency Indication

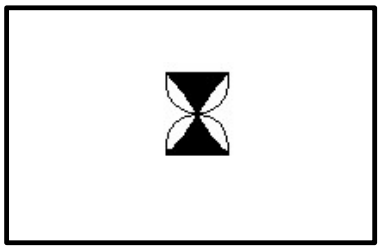
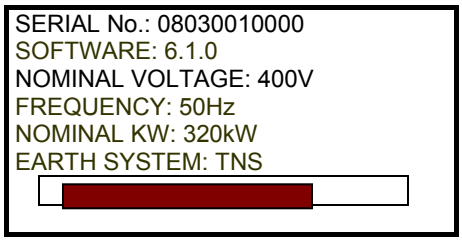
Order of appearance of screens based on the type of network with the genset started.

	Type of line			
Order of appearance	**3P+N**	**3P**	**2P+N**	**1P+N**
1	P3 if genset started P11 if genset coupled	P3 if genset started P11 if genset coupled	P3 if genset started P11 if genset coupled	P3 if genset started P11 if genset coupled
2	P4	P4	P6	P7
3	P5	P8	P8	P9
4	P8	P9	P9	P2
5	P9	P2	P2	P10
6	P2	P10	P10	
7	P10			

The screen is changed using the scrolling and validation wheel.
When the wheel is turned clockwise, the screens scroll upwards and backwards.
The screens scroll in a loop.
Example: in a 3P+N network after screen 7, then screen 1 and in reverse.

6.3.1.6. Display of messages in zone 4

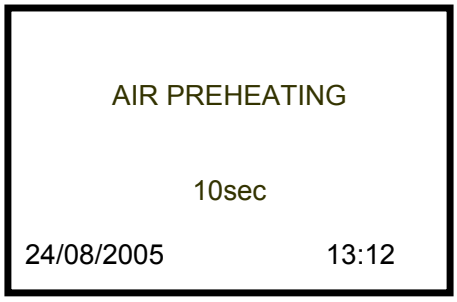
The graphic zone (zone 4) is used to display messages relating to the generating set's operation. These messages are as follows:
Initialisation of the TELYS

Screen No.	Screen	Data displayed
G 1		Initialisation of the TELYS when switching on and/or when loading a configuration
G 2		Generating set serial number TELYS software version Alternator nominal voltage Alternator nominal frequency Nominal active power Neutral speed Bar graph indicating the screen display time

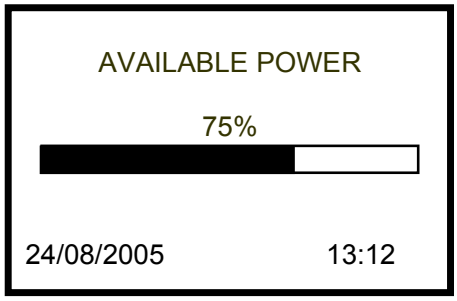
Generating set stopped

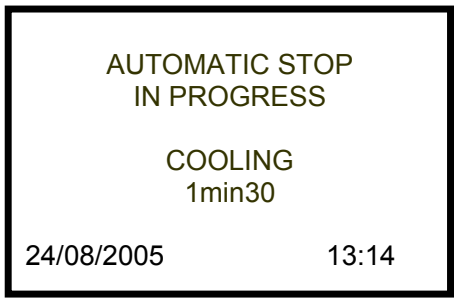
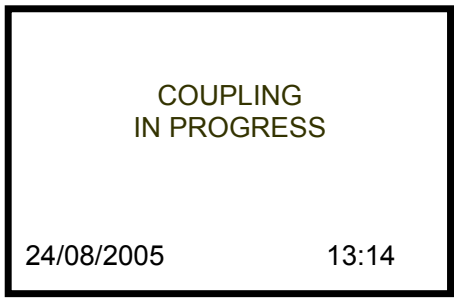
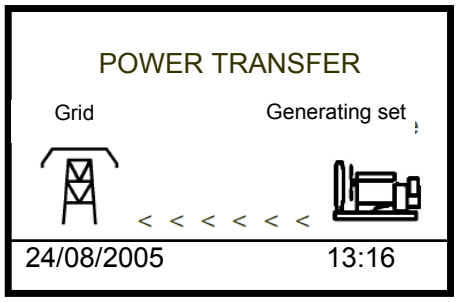
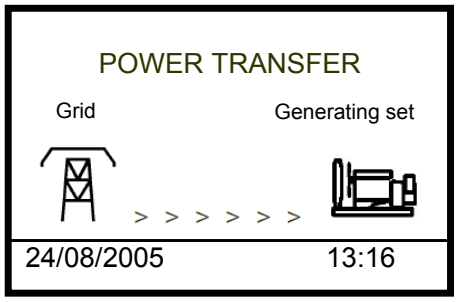
Screen No.	Screen	Data displayed
G 3	MANUAL OPERATION Press START to start 24/08/2005 13:12	Operation mode - genset in MAN mode ready to start Date and time (depending on settings)
G 4	AUTOMATIC OPERATION IMPORTANT IMMEDIATE START-UP POSSIBLE 24/08/2005 13:12	Operation mode - genset in AUTO mode ready to start Date and time (depending on settings)
G 5	IMPORTANT AUTOMATIC starting 19min30 24/08/2005 13:12	Operation mode - genset in AUTO mode with programmed start Countdown of micro disconnection delay OR EJP (for France only) Date and time (depending on settings)

Generating set start-up

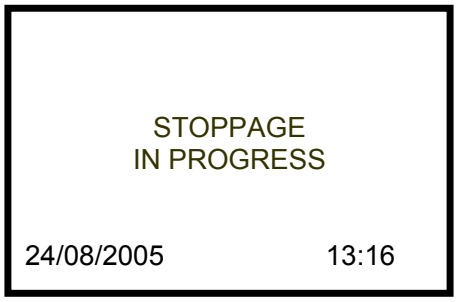
Screen No.	Screen	Data displayed
G 6		Operating phase - genset starting Date and time (depending on settings)
G 7		Operating phase - air preheating prior to genset starting Countdown of the air preheating delay Date and time (depending on settings)

Generating set started

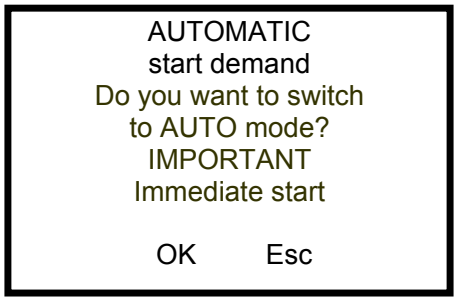
Screen No.	Screen	Data displayed
G 8 Default screen		Operating phase – genset operating – stable voltage and frequency Available power Date and time (depending on settings)
G 9		Operation mode - operation in AUTO mode Power supply device opens (motorised circuit breaker or changeover switch controlled by the TELYS) Countdown of the Mains Return delay OR Test on load delay Date and time (depending on settings)

Screen No.	Screen	Data displayed
G 10		Operation mode - operation in AUTO mode Genset cooling in progress Countdown of the Engine Stop delay (cooling) OR Gradual Stop delay (Water temperature) OR Overload Gradual Stop delay OR No Load Test delay Date and time (depending on settings)
G-10/1		Operation mode - operation in AUTO mode Synchronisation of the genset with the grid or another genset Date and time (depending on settings)
G-10/2		Operation mode - operation in AUTO mode Transfer of power from the generating set to the grid Date and time (depending on settings)
G-10/3		Operation mode - operation in AUTO mode Transfer of power from the grid to the generating set Date and time (depending on settings)

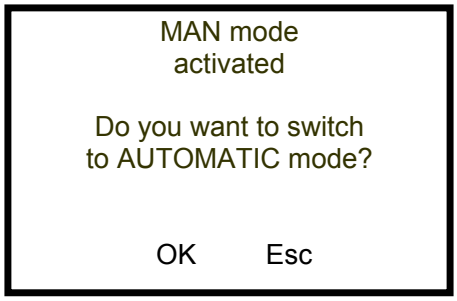
Generating set stoppage

Screen No.	Screen	Data displayed
G 11		Genset stoppage Date and time (depending on settings)

Change of operation mode (switch from MAN mode to AUTO mode when an automatic start demand is issued)

Screen No.	Screen	Data displayed
G 12		Operation mode - operation in MAN mode AUTOMATIC start demand

Generating set stop demand if a fault occurs or if STOP is pressed in AUTO mode

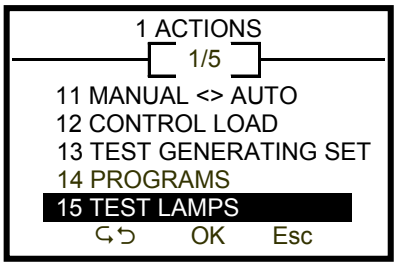
Screen No.	Screen	Data displayed
G 13		Operation mode - operation in AUTO mode (genset running) Warning message for switch to MAN mode if STOP is pressed or if a fault occurs
G 13/1		Operating phase – genset operating – stable voltage and frequency Warning message for setting offset on all of the power plant's generating sets

6.3.2 Starting

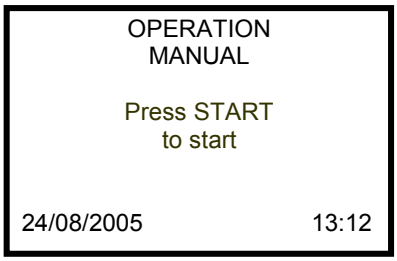
Danger	Check that the generating set circuit breaker has triggered.

❶ Connect the generating set battery
❷ Turn the key switch to the ON position (without forcing it to the ON position), the ON lamp will light up (if the lamp does not light up, check and replace the fuse if necessary)

❸ Test the Alarm and Fault LEDs (menu 15 – TEST LAMPS)

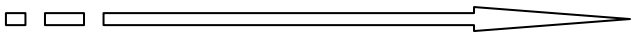


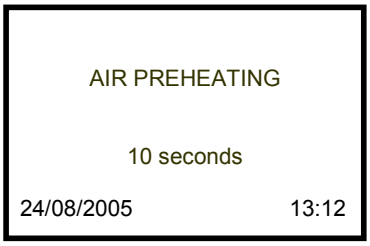
❹ Press "Esc" several times to return to the following home menu



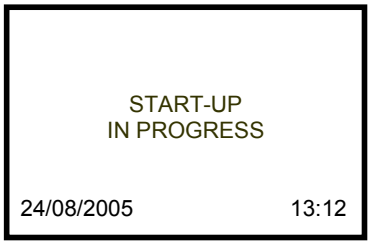
❺Check the battery voltage

❻ Press START:



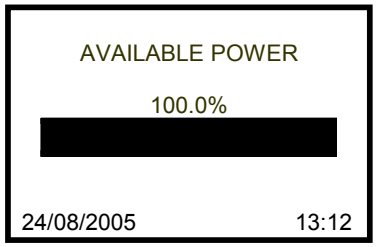


- If the engine is equipped with an air preheating system, there is a delay (adjustable) before the engine starts (preheating activation period).
- If the motor is not fitted with an air preheating system or once the preheating delay has elapsed, the engine starts up (start of a cycle comprising 3 attempts to start up the engine).



Warning: the number of successive and automatic starting attempts is limited to 3.

The following pictogram will flash



The following pictogram is displayed

The following information is displayed

	Speed of rotation	
	Coolant temperature	Options
	Oil pressure	
	Oil Temperature	

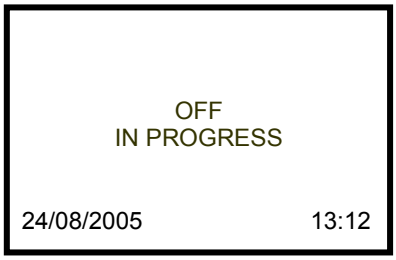
6.3.3 Switching off

❶ Open the circuit breaker
- ➢ manually OR ➢ by selecting menu 12 "CONTROL LOAD"

The following display will disappear (supply stopped)

❷ Press the STOP button

❸ The following screen is displayed and the generating set will stop



❹ Switch TELYS off by turning the key to "OFF" (without forcing it to the "OFF" position).

6.3.4 Alarms and faults

6.3.4.1. Viewing alarms and faults

Alarms and faults are displayed as follows:

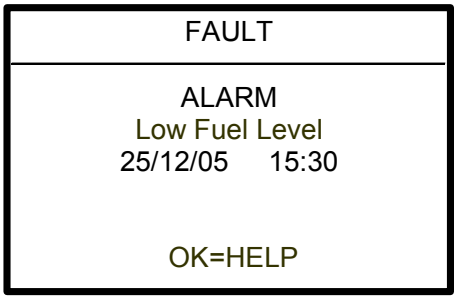
① Alarms

All alarms will cause:

➢ the yellow LED to flash "General alarm".

In conjunction with this LED:
- ➢ a flashing pictogram appears on the LCD screen representing the circuit affected by the alarm and the associated indicator, if present (example)

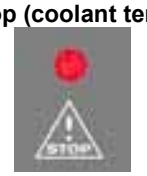
- ➢ message on graphic display (example)



② Faults

All faults will cause:

- **the generating set to stop: immediate or gradual stop (coolant temperature and overload or short circuit)**
- the red LED to flash "General fault".



In conjunction with this LED:

- a flashing pictogram appears on the LCD screen representing the circuit affected by the fault and the associated indicator, if present (example)

- message on graphic display (example)

FAULT
FAULT Oil Pressure 25/12/05 15:30 OK=HELP

Faults have priority over alarms. Faults are displayed in the descending order of their appearance (from the most recent to the oldest).

6.3.4.2. Activation of an alarm or fault

The appearance of an alarm **or** a fault causes the corresponding screen to be displayed (examples below)

FAULT
ALARM Low coolant Level 06/10/06 10:30 OK=HELP

FAULT
FAULT Emergency Stop 06/10/06 15:30 Esc=RESET OK=HELP

Press OK (on the scrolling and selection wheel) to access the help message if it is available (example below)

HELP
Check the level fuel Esc=EXIT

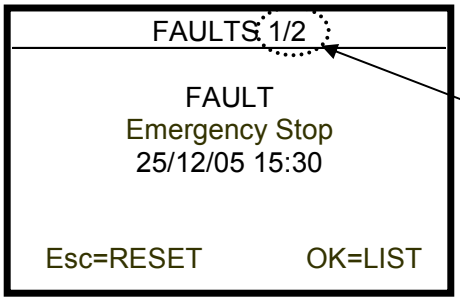
If the alarm is no longer active, it is reset automatically (cause disappears).
Press Esc to reset a fault:

- reset acknowledged if the cause of the fault has been removed
- reset not performed if the cause of the fault is still present.

6.3.4.3. Activation of an alarm and a fault

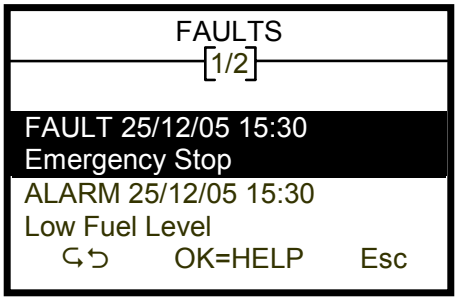
The appearance of an alarm **and** a fault causes:

- The yellow and red LEDs to flash
- the related screen to be displayed (example below)

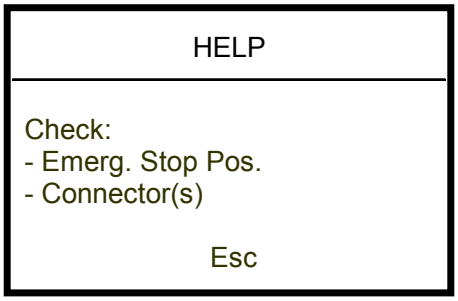


If several faults are present, the number of faults is displayed at the top of the screen.

The faults list can be accessed by pressing OK (of the scrolling and selection wheel) (examples below)



Press Esc to return to the previous screen.
Press OK to go to the HELP screen (help on the highlighted fault)
Use the scrolling and selection wheel to scroll through the list of faults.



If the alarm is no longer active, it is reset automatically (cause disappears).
Press Esc to reset a fault:

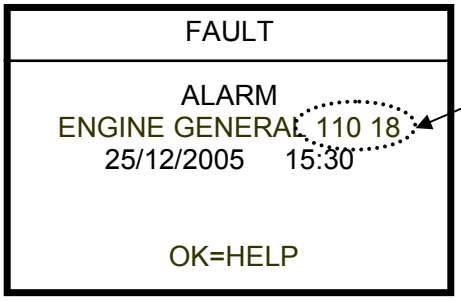
- reset acknowledged if the cause of the fault has been removed
- reset not performed if the cause of the fault is still present.

6.3.4.4. Engine fault codes display

Certain alarms and engine faults generate specific fault codes. These codes are standardised according to the J1939 and/or J1587 standards.

Terminology used by the SAE CAN J1939 standard	
SPN: Suspect Parameter Number	This represents the system or component at fault, for example: SPN 100, indicates an oil pressure problem or a problem with the oil pressure sensor.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault.
Terminology used by VOLVO	
SID: System Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). However, this term corresponds, more particularly, to an assembly of components, for example, the injection system.
PID: Parameter Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). However, this term corresponds, more particularly, to a specific component, for example, a sensor.
PPID: Parameter Identifier	This term, used in the J1587 standard, has an equivalent in the J1939 standard (SPN). PPID corresponds to PID, but is only used by VOLVO.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault. VOLVO uses a SID-FMI or PID-FMI or PPID-FMI combination.
Terminology used by JOHN DEERE	
SPN: Suspect Parameter Number	This represents the system or component at fault, for example: SPN 100, indicates an oil pressure problem or a problem with the oil pressure sensor.
FMI: Failure Mode identifier	This represents the type of fault that has occurred. This may be an electrical, mechanical or equipment fault.

In the event of a fault, the screen will display the following message:



Engine fault code.
Pressing OK will display fault finding information.
In addition, appendix D indicate the meaning of the code. The checking and maintenance operations to carry out in order to solve the fault are included in the user and maintenance manuals of the engines supplied with the generating set documentation.

For JOHN DEERE (JD) and VOLVO (VO) engines, the codes displayed are SPN and FMI codes.

6.3.4.5. Horn reset

Depending on the settings made (menu 363 - HORN), the activation of an alarm and/or a fault leads to the horn sounding and the following screen appearing:

This screen will display first any messages relating to the alarms and faults that appear as soon as OK is pressed.

7. Maintenance schedule

7.1. Reminder of use

The maintenance interval frequency and the operations to be carried out are outlined in the maintenance schedule, given as a guideline.
N.B. the environment in which the generating set is operating determines this schedule.
If the generating set is used in extreme conditions, shorter intervals between maintenance procedures should be observed
These maintenance intervals only apply to generating sets running on fuel, oil and coolant which conform to the specifications given in this manual.

7.2. Maintenance safety instructions

Before each operation, please observe the following maintenance safety instructions:

- ✓ read the safety instructions carefully (chapter 1),
- ✓ refer systematically to the maintenance instructions,
- ✓ the battery isolating switch must be in the open position,
- ✓ no operations must be carried out while the motor is running,
- ✓ wear protective equipment (gloves, goggles, safety shoes etc.),
- ✓ before operating on a pressurised circuit, ensure that the circuit pressure has been reduced (atmospheric pressure),
- ✓ after the operations, ensure that the equipment is clean, or clean it if necessary.

7.3. Table of maintenance operations

OPERATIONS	10 h / Daily	500 h	1 000 h 1 year	2 000 h 2 years	5000 h	10 000 h	20 000 h 3 years
Generator set							
• Check the general condition			●				
• Check the tightening torques			●				
• Check the absence of leaks		●					
• Check the condition of battery charge		●					
• Clean the battery terminals		●					
• Check condition and connections of electrical equipment		●					
• Clean with compressed air the relays and contactors		●					
Engine							
• Check engine oil and coolant level	●						
• Check air filter restriction indicator[a]	●						
• Check the fuel filter	●						
• Change engine oil and filter[b]		●					
• Check belt tension and tensioner		●					
• Replace fuel filter element(s)		●					
• Pressure test cooling system			●				
• Clean crankcase vent tube			●				
• Check air intake hoses, connections and system			●				
• Check and adjust valve clearance[c]				●			
• Check engine speed and speed drop governor				●			
• Drain and flush cooling system				●			
• Test glow plugs				●			
• Replace injection nozzles					●		
• Replace thermostat						●	
Alternator							
• Check the tightening torques	After the first 20 hours						
• Check the general condition							
• Check the various electrical connections of the installation							
• Grease the bearings							●

[a] Clean air filter element when restriction indicator is red. Replace filter element after 6 cleanings or once a year.
[b] After the first 100 hours of operation. Change oil and filter at least once a year.
[c] After the first 500 hours of operation.

7.4. Cover maintenance

!	The sealing between the cover and the frame and between the frame and the retention tank is ensured by a gasket. It is essential to replace the gasket if the cover has been removed.
IMPORTANT	

Users must maintain the enclosures and base frames to ensure that the paintwork retains all its protective properties.

7.5. Trailer maintenance

Operations / Frequency		When commissioning and before towing	Every 6 months	Every year
Check	General condition of the vehicle	●		
	Tyre pressure	●		
	Tighten the wheel nuts	●		
	Efficiency of the automatic brake		●	●
	Efficiency of the parking brake		●	●
	Braking adjustment and distribution across all wheels		●	●
	Wear on brake linings and drums			●
	No play in the hubs			●
	Play in the clamping tube			●
	Play in the ball socket or ring			●
Lubricate	Braking control hinges and joints		●	●
	Stabilising		●	●

Lubricate or grease the moving parts on the coupling device (see lubrication point examples in the Figure 23).

✓ Recommended lubricant: general purpose grease compliant with DIN 51825 KTA 3KA.

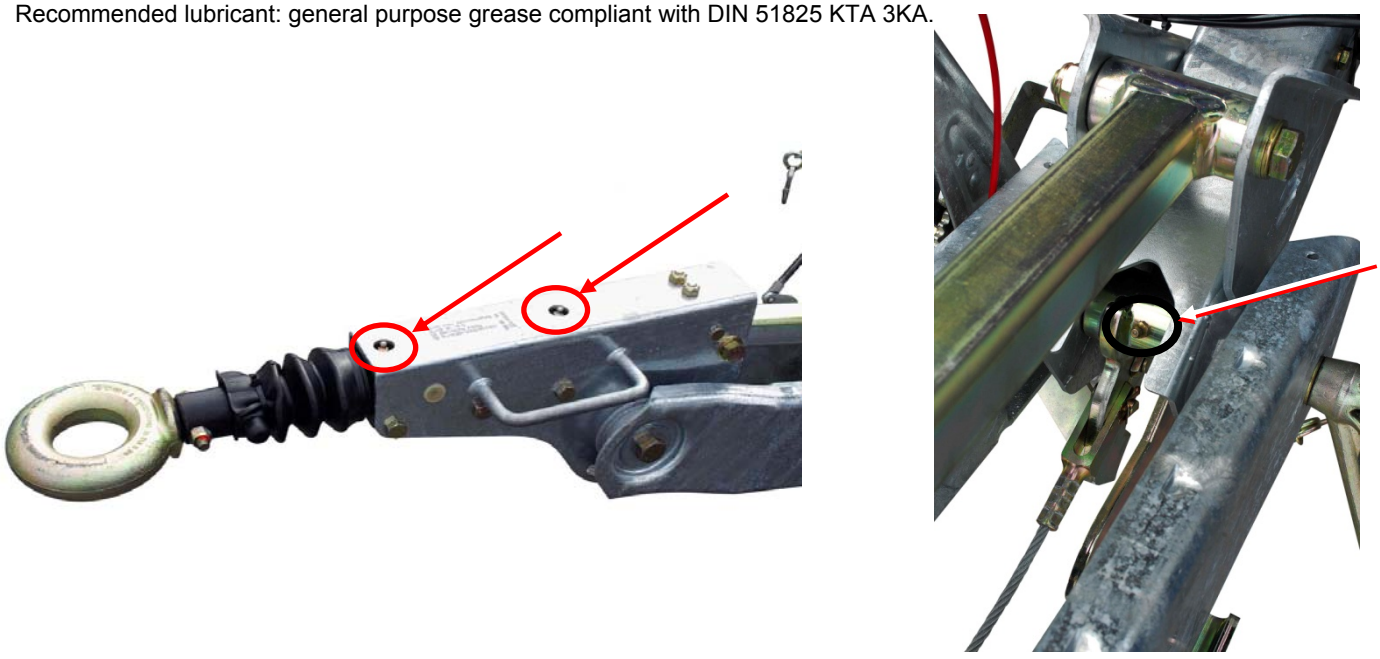


Figure 23 : Trailer lubrication/greasing points

7.6. Common Spare Parts

GenPARTS

R66C2C
Rental Power

JOHN DEERE
4045TFS70

-ENGINE

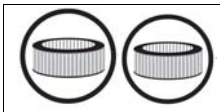
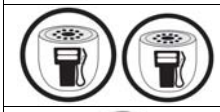
Starter motor brush	330362331	X 1
Radiator cap	31802000304	X 1
Charging alternator diode bridge	330360144	X 1
Fan belt	330360183	X 1
Thermostat	330360012	X 1
Thermostat seal	330361286	
Alarm oil pressure sensor	330360059	X 1
Alarm water temperature sensor	330360060	X 1

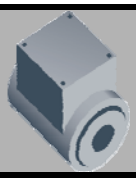
GENLUB

x 20 L	330910115	X 1
x 208 L	330910095	

GENCOOL

x 20 L	330910098	X 1
x 60 L	330910099	
x 210 L	330910100	

	330570092 + 330570118	X 1
	330560611 + 330510015	x 1
	330361669	x 1



LEROY-SOMER
LSA432M45

ALTERNATOR

Diode bridge	330410713	x 1
Varistor	330410335	X 1

For any need of spare parts, please contact:

Spare Parts department
✆ : +33(0)02.98.41.13.07
e-mail :genparts@sdmo.com

To find your nearest center service, please consult our website:

www.sdmo.com

7.7. Fault finding

Refer to the user manual and engine and alternator maintenance manuals appended.
Additionally, in the event of an abnormal rise in engine temperature, check that the radiator is clean.

7.8. No load and under load tests

Notes on operation at no load and under load:

When operating at no load or low load (< 30% of nominal power), the operating conditions do not allow optimum running of the engine. The main causes are as follows:

- ✓ The low volume of fuel burned in the combustion chamber leads to incomplete combustion; the resulting thermal energy means that the optimum engine operating temperature cannot be reached.
- ✓ Overheated engines have lower compression ratios (low compression ratio without turbocharging), which are defined for full load and not suitable for good combustion at low load.

All of these factors lead to choking of the engine, in particular the piston rings and valves, which leads to:

- ✓ Accelerated wear and glazing of the cylinder liners
- ✓ Loss of sealing of seats, and sometimes sticking of valve stems.

Consequently, operating any turbocharged engine at low load (< 30%) can only have adverse repercussions on an engine's operation and its service life. Maintenance intervals will have to be shortened to accompany harsh operating conditions. Shortening draining intervals, among other things, will enable you to change the oil more frequently, which will tend to be choked with unburnt particles and contaminated with fuel. Adding a load bench is generally used to limit low load phases, and obtain the periodic full loads necessary to unchoke the engine.
Finally, when operating under load, we advise vigilance towards the oil breather circuit, and more particularly towards engines which have the crankcase vent connected to the turbocharger inlet (risk of oil or oil vapour absorption and accelerated engine speed).

On load tests:

It is recommended to conduct an on load test on the generating set monthly, for a period of around 1 hour after stabilisation of the parameters.
The load must be greater than 50% of nominal power (ideally 80%), to ensure unchoking of the engine and to obtain a decent picture of the generating set operation.

Off load test (no load):

This test is not recommended; it must not exceed 10 minutes, and must not be repeated without a monthly on load test. This test only allows you to check for correct engine start-up. It does not allow you to check that the generating set is working properly.

8. Starter batteries

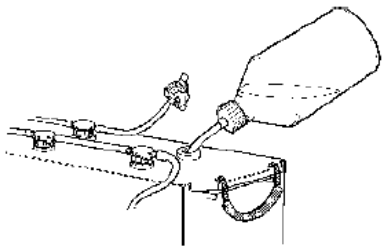
DANGER

Risk of explosion or fire (oxygen and hydrogen present). The battery must never be exposed to any naked flames or sparks.

Risk of sparks forming and an explosion. When fitting the battery, never invert the polarities.
Do not short the battery terminals with a tool or other metal object.

Risk of injury. Battery electrolyte is extremely corrosive. Always protect your eyes, skin and clothing when handling batteries. Always wear protective goggles and gloves.
In the event of contact with the skin, wash thoroughly with water and soap. If the eyes are splashed, rinse thoroughly with water and consult a doctor immediately.

8.1. Checking the electrolyte level



The electrolyte level must be approximately 10 mm above the battery plates.

1. Top up with distilled water if necessary.
2. Pour the distilled water carefully to avoid any splashes.

Wear protective goggles and rubber gloves when handling the battery (adding water, charging, etc.).

Note: some batteries requiring no maintenance form the subject of specific instructions which must be respected.

After the battery has been topped up, it must be recharged for at least 30 minutes.

8.2. Checking the voltage/acid density

Every 2 months, the following checks must be performed:

1. Check the density of the acid contained in the cells (all the battery cells must have the same density; if this is not the case, the battery must be replaced)
2. Check the voltage when idle.

Acid density	Charge status	Voltage when idle	Observation / action
1.27	100%	Above 12.60 V	
1.25	80%	12.54 V	
1.20	60%	12.36 V	**From 60% recharge**
1.19	40%	12.18 V	**Risk of sulphation**
1.13	20%	Below 11.88 V	**Unusable**

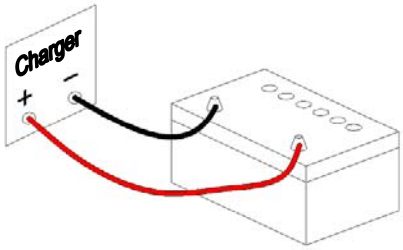
The results of the density and voltage measurements make it possible to define the charge status of the battery. If the charge status is less than 60%, the battery must be recharged.

8.3. Charging the battery

Highly discharged or sulphated batteries (formation of whitish lead sulphate deposit on the plates, which becomes hard) can no longer regenerate or be charged in a generating set.

!	A discharged battery should be recharged immediately, or else it will suffer irreparable damage.
IMPORTANT	

Battery charge



Example of charge:

- 12V 60 Ah battery = 6 A charging current;
- Charge status: 50% (acid density 1.19 and voltage when idle 12.30V);
- The battery is short 30 Ah, and this must be recharged.
- Charge factor: 1.2;
- 30 Ah x 1.2 = 36 Ah to be charged;
- Charging current: 6A, approximately 6 hours charging required; the charging current must always be 1/10th of the nominal capacity of the battery.

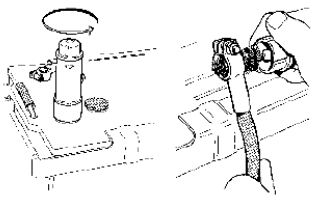
Recharging is complete when the battery voltage and the acid density stop increasing.

The power of the charger must be suitable for the battery to be charged and the charging time available.

Note: if several batteries connected together are being recharged, the following points must be checked:

- *Are the batteries connected in series?*
- *Is the voltage chosen exact? 1 battery x 12 V, 3 x 36V batteries.*
- *Adjust the charge current to the lowest battery.*
- *The power difference between the batteries must be as low as possible.*

8.4. Cleaning the battery



Keep the batteries clean and dry. The presence of impurities and rust on the battery and terminals may cause the current jumps, voltage drops and the battery to discharge, particularly in humid weather.

1. Clean any signs of oxidation on the battery terminals and the cable terminals using a brass brush.
2. Fully tighten the cable terminals and lubricate them with grease for battery terminals or vaseline. A terminal which is not secured correctly may cause sparks and therefore lead to an explosion.

8.5. Fault finding

Fault observed	Probable origin	Measures or observations
The acid heats up when a new battery is filled	Incorrect composition Incorrect storage Prolonged storage in a damp place	Cool Charge the battery Check the acid density
The acid escapes through the filler holes	The battery is too full	Reduce the battery fluid level
Acid level too low	Battery tray not leaktight Considerable formation of gas due to a very high charging voltage	Replace the battery Check the charger and repair if necessary
Acid level too low Incorrect operation from start-up	Insufficient charge Short circuit in the power circuit Consumption fault	Recharge the battery Check the electrical installation
Acid density too high	The battery has been filled with acid instead of water	Reduce the acid level and fill with distilled water. Repeat the operation if necessary
Starting problems Starting test incorrect	Battery empty Battery exhausted or faulty Capacity too low Battery sulphated	Recharge the battery Replace the battery
Battery terminals melted	Incorrect electrical connection Battery cabling incorrect	Tighten the ends of the battery cables or replace them if necessary and replace the battery
One or two cells release a lot of gas at high charge	Faulty cell(s)	Replace the battery
The battery discharges very quickly	Charge status too low Short circuit in the power circuit High self-discharge (for example: through electrolyte contamination) Sulphation (storage of discharged battery)	Check the load Replace the battery
Short service life	Incorrect battery part no Repeated deep discharging Battery stored too long without charge	Define the correct battery part no. for the recommended use It is recommended to charge the battery using a regulator
High water consumption	Overload Charging voltage too high	Check the charger (voltage regulator).
The battery explodes	Sparks after battery charging Short circuit Connection or disconnection during charging Internal fault (for example: interruption) and low electrolyte level	Replace the battery

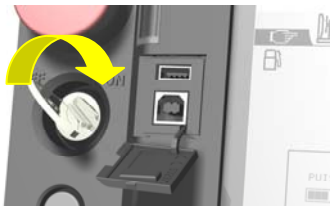
9. Options

9.1. Dual frequency

IMPORTANT	This operation must be carried out by a qualified electrician. These operations must only be carried out when the generating set is stopped, until you are instructed to start up the generating set.

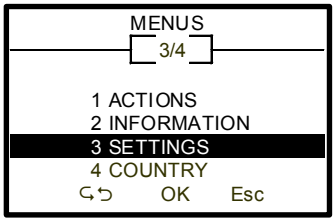
- Close the battery isolating switch to turn on the TELYS 2.

- Turn the supply switch of the TELYS 2 to the "ON" position.

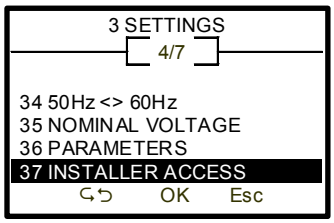


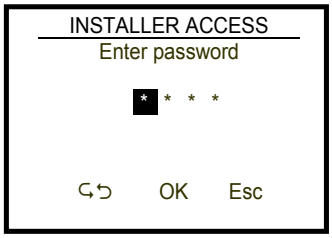
- Press the "MENU" key.

- Using the knob, select "3 SETTINGS" and press the knob to confirm.

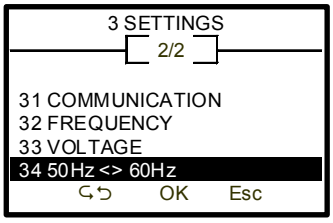


- As not all the settings are available, go to the "37 INSTALLER ACCESS" menu to enter the code "1966" using the knob to call up the desired menus.

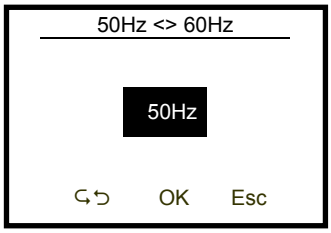




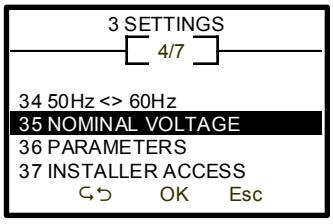
- Using the knob, select "34 50Hz<>60Hz" and press the knob to confirm.



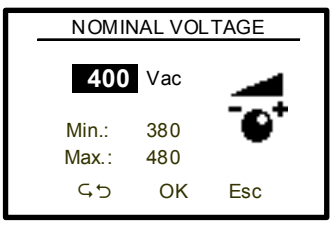
- Select and confirm the desired frequency using the knob to scroll and confirm (50 Hz or 60 Hz).



- Return to the "3 SETTINGS" screen and use the knob to select "35 NOMINAL VOLTAGE" then press the knob to confirm.



- Set the desired voltage then confirm using the scroll and confirm knob.



- Select the desired configuration using the configuration option selector located next to the TELYS 2 control unit.

Configuration selector

- Start up the generating set by pressing the "START" button.

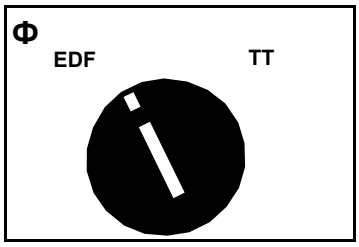
- Adjust the voltage after starting up the generating set using the 2003R08 potentiometer.

Potentiometer

IMPORTANT	Warning: when switching to 60Hz, do not use sockets if fitted to the generating set.

9.2. Neutral system

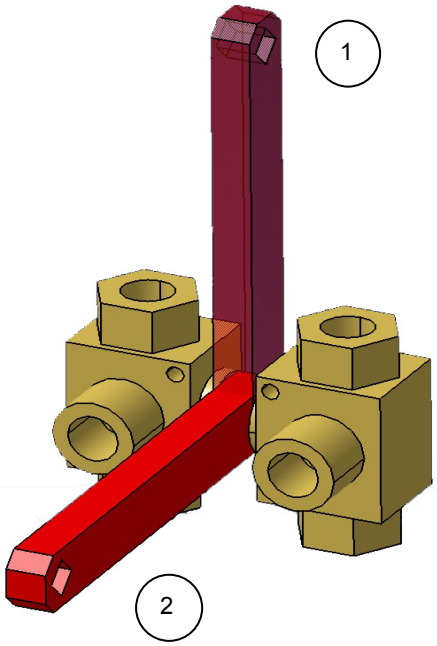
Turn the switch to the desired neutral system.



Important	**Select the neutral system with the generating set switched off.**

9.3. Fuel supply valve

The 3-way valve is used to select between the generating set fuel tank and an external fuel supply.



Valve in vertical position (no. 1): generating set supplied by the daily service tank.
Valve in horizontal position (no. 2): generating set supplied by the external tank.

10. Appendix

10.1. Appendix A – Engine user and maintenance manual

User guide and maintenance manual

JOHN DEERE

Engine

3029TF120
3029DF120
6068TF220
4045TF220
4045HF120
4045TF120
6068HF120-153
3029TFS70 (TF270)
3029HFS70 (HF270)
4045HFS72 (HF275)
4045HFS73 (HF279)
4045HFS80 (HF280)
4045HFS82 (HF285)
4045HFS83 (HF285)
4045TFS70 (TF270)
6068HFS72 (HF275)
6068HFS73 (HF279)
6068HFS76 (HF475)
6068HFS77 (HF475)
6068HFS82 (HF285)
6068HFS83 (HF285)
6068HFS89 (HF485)

OMCD16564
06/07/2009
33522039401_4_1

Engines & Power Units for Generator Sets (Saran-Built)

OPERATOR'S MANUAL

Engines & Power Units for Generator Sets (Saran-Built)

OMCD16564 ISSUE G9 (ANGLAIS)

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

If this product contains a gasoline engine:

⚠ WARNING

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

The State of California requires the above two warnings.

John Deere Usine De Saran
(This manual replaces OMCD16564 F8)
European Version
PRINTED IN GERMANY

Foreword

THIS MANUAL COVERS the following engines for generator sets:

Non Emission Certified Engines (Mechanical Fuel System)

CD3029DF120
CD3029DF128
CD3029TF120
CD3029TF158
CD4039DF008
CD4039TF008
CD4045DF158
CD4045HF120
CD4045HF158
CD4045TF120
CD4045TF158
CD4045TF220
CD4045TF258
CD6068HF120
CD6068HF158
CD6068HF258
CD6068TF158
CD6068TF220
CD6068TF258

Emission Certified Engines (Stage II according to Directive 97/68/EC)

CD3029HFS70 (Mechanical Fuel System)
CD3029HFU70 (Mechanical Fuel System)
CD3029TFS70 (Mechanical Fuel System)
CD3029TFU70 (Mechanical Fuel System)
CD4045HFS72 (DE10 Fuel System)
CD4045HFS73 (HPCR System, 2-Valve Head)
CD4045HFU72 (DE10 Fuel System)
CD4045HFU79 (HPCR System, 2-Valve Head)
CD4045TFS70 (Mechanical Fuel System)
CD4045TFU70 (Mechanical Fuel System)
CD6068HFS72 (DE10 Fuel System)
CD6068HFS73 (HPCR System, 2-Valve Head)
CD6068HFS76 (HPCR System, 4-Valve Head)
CD6068HFS77 (HPCR System, 4-Valve Head)
CD6068HFU72 (DE10 Fuel System)
CD6068HFU74 (HPCR System, 4-Valve Head)
CD6068HFU79 (HPCR System, 2-Valve Head)

Emission Certified Engines (EPA Tier 2)

CD3029TF270 (Mechanical Fuel System)
CD4045TF270 (Mechanical Fuel System)
CD6068HF275 (VP44 Fuel System)
CD6068HF475 (HPCR System, 4-Valve Head)

Emission Certified Engines (EPA Tier 3)

CD4045HFS80 (Mechanical Fuel System)
CD4045HFS82 (HPCR System, 2-Valve Head)
CD4045HFS83 (HPCR System, 2-Valve Head)
CD6068HFS82 (HPCR System, 2-Valve Head)
CD6068HFS83 (HPCR System, 2-Valve Head)
CD6068HFS89 (HPCR System, 4-Valve Head)

READ THIS MANUAL carefully to learn how to operate and service your engine correctly. Failure to do so could result in personal injury or equipment damage.

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your engine and should remain with the engine when you sell it.

MEASUREMENTS IN THIS MANUAL are given in metric. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

WRITE ENGINE SERIAL NUMBERS and option codes in the spaces indicated in the Serial Number Section. Accurately record all the numbers. Your dealer also needs these numbers when you order parts. File the identification numbers in a secure place off the engine or machine.

RIGHT-HAND AND LEFT-HAND sides are determined by standing at the drive or flywheel end (rear) of the engine and facing toward the front of the engine.

SETTING FUEL DELIVERY beyond published factory specifications or otherwise overpowering will result in loss of warranty protection for this engine.

Information relative to emissions regulations
Depending on final destination, this engine can meet the emissions regulations according to the US Environmental Protection Agency (EPA), California Air Resources Board (CARB) and for Europe, the Directive 97/68/EC relating the measures against the emissions of gaseous and particulates pollutants from internal combustion engines. In this case an emission label is stuck on the engine.

Emission regulations prohibit tampering with the emission-related components listed below which would render that component inoperative or to make any adjustment on the engine beyond published specifications. It is also illegal to install a part or component where the principal effect of that component is to bypass, defeat, or render inoperative any engine component or device which would affect the engine conformance to the emissions regulations. To summarize, it is illegal to do anything except return the engine to its original published specifications.

Continued on next page

List of emission-related components:
- Fuel injection pump
- Intake manifold
- Turbocharger
- Charge air cooling system
- Piston

CALIFORNIA PROPOSITION 65 WARNING

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

DPSG,CD03523,1 -19-06JUL09-2/2

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2500 Hours of operation 02- 4
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4500 Hours of operation 02- 6
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7500 Hours of operation 02- 9
8000 Hours of operation 02- 9
8500 Hours of operation 02-10
9000 Hours of operation 02-10
9500 Hours of operation 02-11
10000 Hours of operation 02-11

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Original Instructions. All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

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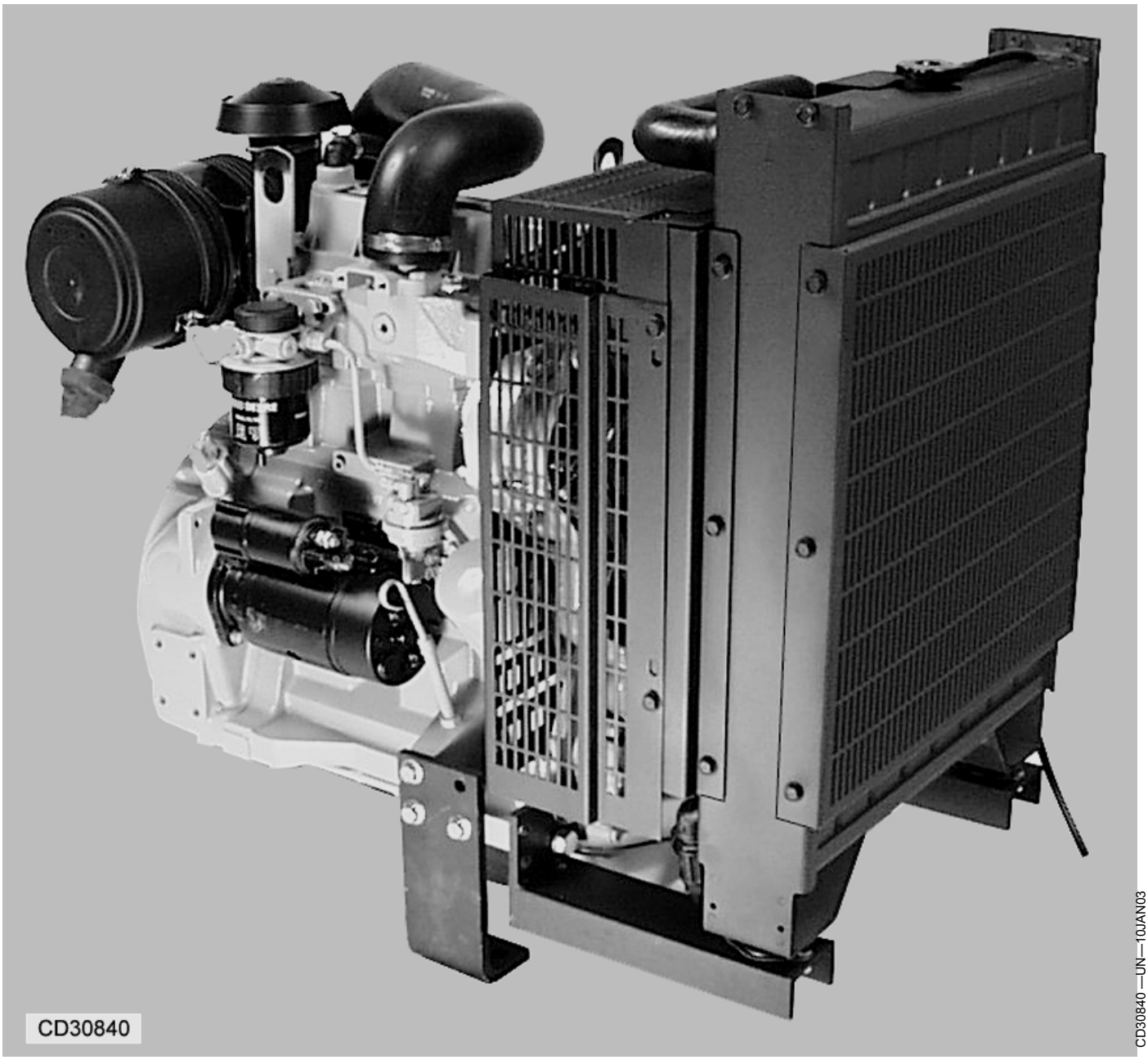

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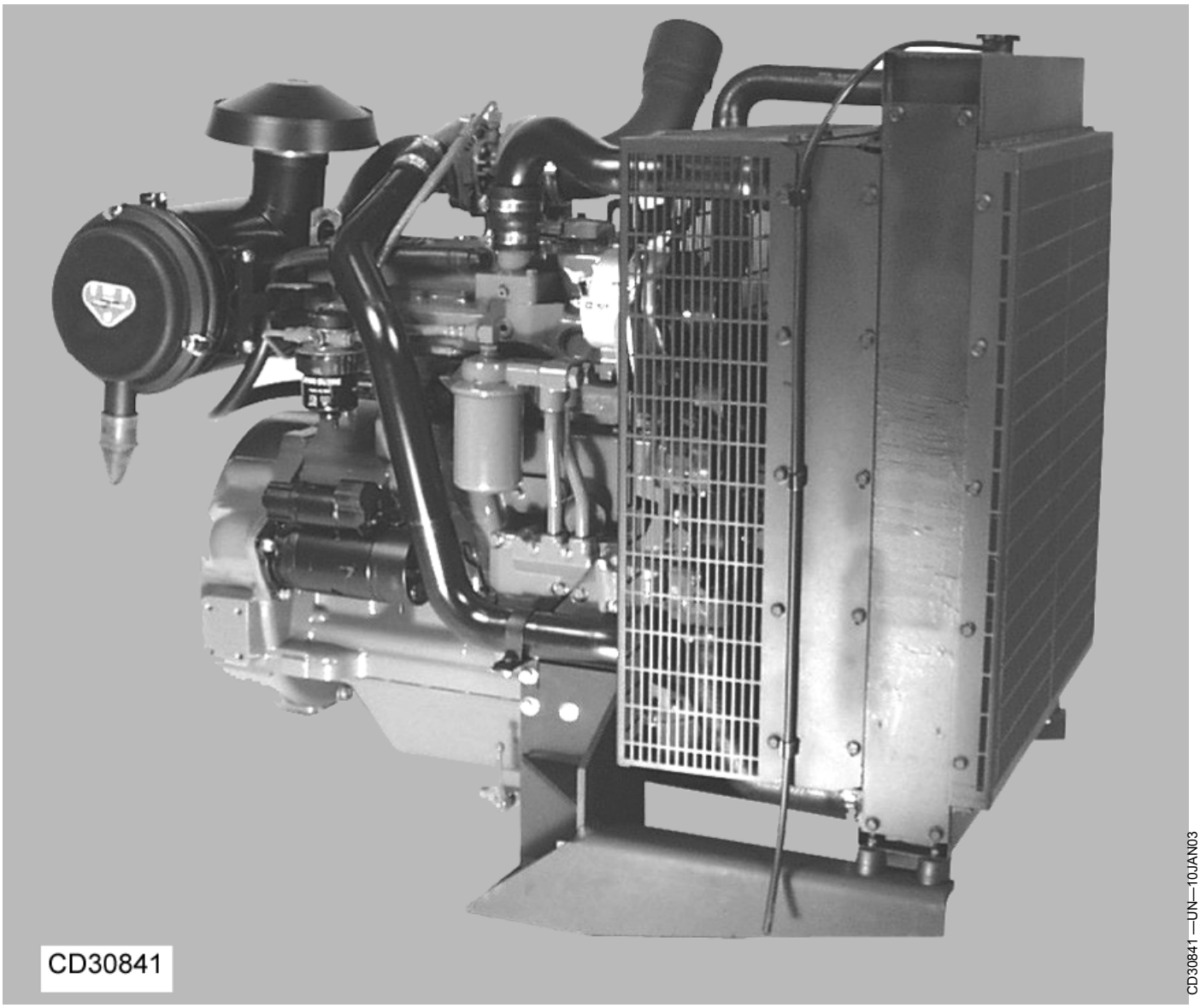

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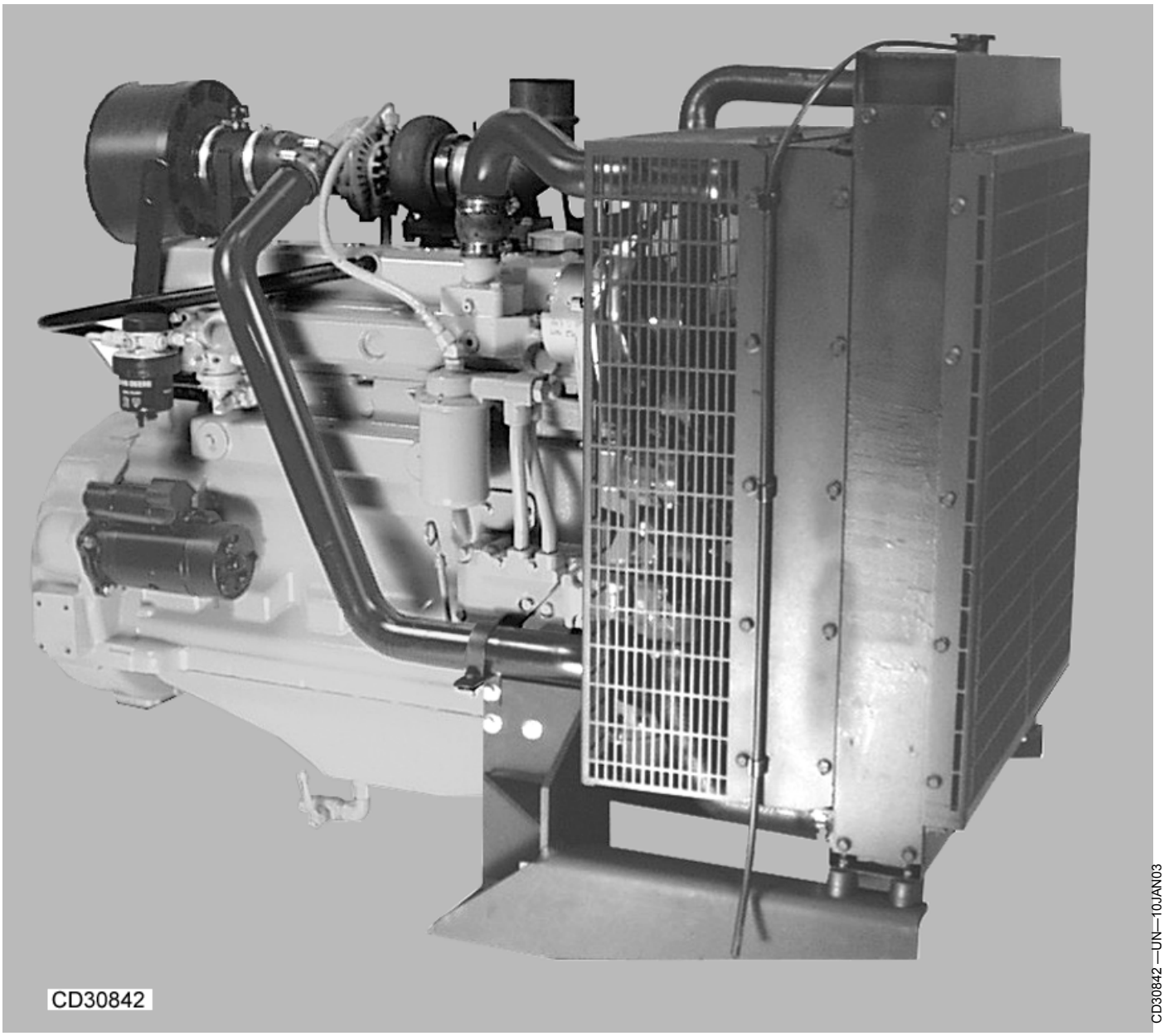


6068HF258

DPSG,CD03523,3 -19-22JAN07-3/3

Maintenance Records

Using maintenance records

To obtain the best performance, economy and service life from your engine, ensure service is carried out according to this present manual and recorded in the following pages. It is recommended that your engine Distributor or your Dealer carry out this service work and stamp the appropriate case.

Keeping an accurate account of all service performed on your engine will give more value to the machine when resell it.

John Deere oils and coolants have been formulated to give maximum protection and performance to your engine. We recommend only genuine John Deere service products and replacement parts.

To protect your rights under the warranty ensure all scheduled services are carried out and recorded. If your engine is covered by extended warranty, it is important to maintain this record for the duration of the warranty.

DPSG,CD03523,6 -19-22JAN07-1/1

100 Hours of operation

□ Engine oil, drain □ Engine oil filter, replace □ Hose connections, check	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,7 -19-22JAN07-1/1

500 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,8 -19-22JAN07-1/1

1000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Air intake system, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,9 -19-22JAN07-1/1

1500 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,10 -19-22JAN07-1/1

2000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Cooling system, drain and flush (if COOL-GARD is not used)

□ Valve clearance, adjust (POWERTech)

□ Air intake system, check

□ Vibration damper, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,59 -19-22JAN07-1/1

2500 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

□ Cooling system, drain and flush (if COOL-GARD is used)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,60 -19-22JAN07-1/1

3000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Air intake system, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,61 -19-22JAN07-1/1

3500 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,62 -19-22JAN07-1/1

4000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Cooling system, drain and flush (if COOL-GARD is not used)

□ Valve clearance, adjust (POWERTech)

□ Air intake system, check

□ Vibration damper, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,63 -19-22JAN07-1/1

4500 Hours of operation

□ Engine oil, drain

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

□ Vibration damper, replace (6 cyl.)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,64 -19-22JAN07-1/1

5000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Injection nozzles, replace

□ Air intake system, check

□ Cooling system, drain and flush (if COOL-GARD is used)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,65 -19-22JAN07-1/1

5500 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,66 -19-22JAN07-1/1

6000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Cooling system, drain and flush (if COOL-GARD is not used)

□ Valve clearance, adjust (POWERTech)

□ Air intake system, check

□ Vibration damper, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,67 -19-22JAN07-1/1

6500 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,68 -19-22JAN07-1/1

7000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Air intake system, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,69 -19-22JAN07-1/1

7500 Hours of operation

□ Engine oil, drain	□ Cooling system, drain and flush (if COOL-GARD is used)
□ Engine oil filter, replace	
□ Fuel filter, replace	
□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)	
□ Valve clearance, adjust (300-Series)	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,70 -19-22JAN07-1/1

8000 Hours of operation

□ Engine oil, drain	□ Cooling system, drain and flush (if COOL-GARD is not used)
□ Engine oil filter, replace	□ Valve clearance, adjust (POWERTech)
□ Fuel filter, replace	□ Air intake system, check
□ Check belt and tensioning system	□ Vibration damper, check
□ Crankcase vent tube, clean	

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,71 -19-22JAN07-1/1

8500 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,72 -19-22JAN07-1/1

9000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Air intake system, check

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,73 -19-22JAN07-1/1

9500 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Belt, check tension and wear (300-Series and POWERTech with manual tensioner)

□ Valve clearance, adjust (300-Series)

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,74 -19-22JAN07-1/1

10000 Hours of operation

□ Engine oil, drain

□ Engine oil filter, replace

□ Fuel filter, replace

□ Check belt and tensioning system

□ Crankcase vent tube, clean

□ Air intake system, check

□ Cooling system, drain and flush

□ Valve clearance, adjust (POWERTech)

□ Thermostat, replace

□ Vibration damper, check

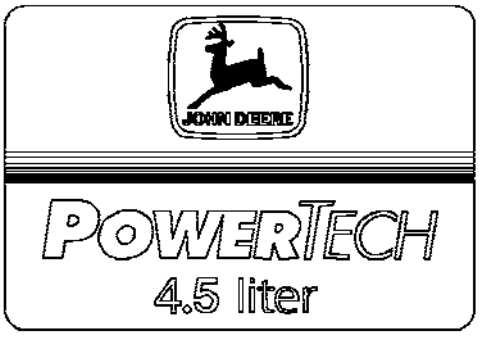
□ Injection nozzles, replace

Number of hours: Date: Job done by:	Observation:	Dealer or distributor stamp

DPSG,CD03523,75 -19-22JAN07-1/1

PowerTech label

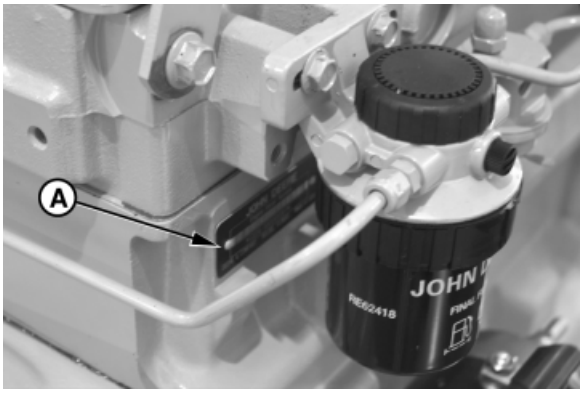
A label is located on the rocker arm cover which identifies each engine as a John Deere PowerTech engine.



RG8041 —UN—15JAN99

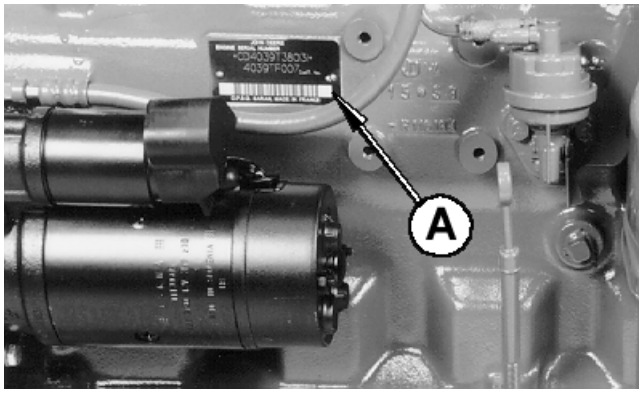
DPSG,CD03523,11 -19-10JUL09-1/1

Engine serial number plate



RG8007 —UN—15JAN99

4045 and 6068 Engines



CD30746 —UN—24SEP99

3029 and 4039 Engines

Each engine has a 13–digit John Deere serial number. The first two digits identify the factory that produced the engine:

”CD” indicates the engine was built in Saran, France

Your engine’s serial number plate (A) is located on the right-hand side of cylinder block behind the fuel filter for 4045 and 6068 engines and near the fuel supply pump on 3029 and 4039 engines.

DPSG,CD03523,12 -19-22JAN07-1/1

Record engine serial number

Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

This information is very important for repair parts or warranty information.

Engine Serial Number (B)

_____

Engine Model Number (C)

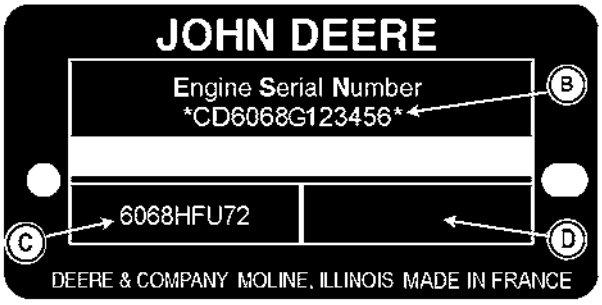
_____

Coefficient of Absorption Value (D)

_____

CD30705B —UN—24AUG99

3029 and 4039 engine plate



CD30747A —UN—22JAN07

4045 and 6068 engine plate

DPSG,CD03523,13 -19-22JAN07-1/1

Engine option codes

CD30748A —UN—26AUG99

Engine option code label

In addition to the serial number plate, OEM engines have an engine option code label affixed to the rocker arm cover. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

An additional sticker may be also delivered (in a plastic bag attached to the engine or inserted in the machine documentation). It is recommended to stick this option code list sticker either:

- On this page of your Operator's manual below this section.
  or
- On the "Engine Owner's Warranty" booklet under the title OPTION CODES (Engine manufacturing configuration).

NOTE: The Machine Manufacturer may have already stuck it at a specific accessible place (inside the enclosure or close to a maintenance area).

The engine option code label includes an engine base code (A). This base code must also be recorded along with the option codes. At times it will be necessary to furnish this base code to differentiate two identical option codes for the same engine model.

The first two digits of each code identify a specific group, such as alternators. The last two digits of each code identify one specific option provided on your engine, such as a 12-volt, 55-amp alternator.

NOTE: These option codes are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

If an engine is ordered without a particular component, the last two digits of that functional group option code will be 99, 00, or XX. The list on the next page shows only the first two digits of the code numbers. For future reference such as ordering repair parts, it is important to have these code numbers available. To ensure this availability, enter the third and fourth digits shown on your engine option code label in the spaces provided on the following page.

NOTE: NOTE: Your engine option code label may not contain all option codes if an option has been added after the engine left the producing factory.

If option code label is lost or destroyed, consult your servicing dealer or engine distributor selling the engine for a replacement.

Option Codes	Description	Option Codes	Description
Engine Base Code:_____			
11____	Rocker Arm Cover	50____	Oil Pump
12____	Oil Filler Neck	51____	Cylinder Head With Valves
13____	Crankshaft Pulley	52____	Auxiliary Gear Drive
14____	Flywheel Housing	53____	Fuel Heater
15____	Flywheel	54____	Oil heater
16____	Fuel Injection Pump	55____	Shipping stand
17____	Air inlet	56____	Paint Option
18____	Air cleaner	57____	Coolant Inlet
19____	Oil pan	59____	Oil Cooler
20____	Coolant pump	60____	Add-on Auxiliary Drive Pulley
21____	Thermostat Cover	62____	Alternator Mounting
22____	Thermostat	63____	Low Pressure Fuel Line

Continued on next page

DPSG,CD03523,14 -19-22JAN07-1/2

Option Codes	Description	Option Codes	Description
23____	Fan Drive	64____	Exhaust Elbow
24____	Fan Belt	65____	Turbocharger
25____	Fan	66____	Temperature Switch
26____	Engine Coolant Heater	67____	Electronic Tachometer Sensor
27____	Radiator	68____	Damper
28____	Exhaust Manifold	69____	Engine Serial Number Plate
29____	Ventilator System	72____	ECU Electronic Software Option
30____	Starting Motor	74____	Air conditioner Compressor Mounting
31____	Alternator	75____	Air Restriction Indicator
32____	Instrument Panel	76____	Oil Pressure Switch
35____	Fuel Filter	81____	Primary Fuel Filter
36____	Front Plate	83____	Electronic Software
37____	Fuel Transfer Pump	84____	Electrical Wiring Harness
39____	Thermostat Housing	86____	Fan Pulley
40____	Oil Dipstick	87____	Automatic Belt Tensioner
41____	Belt Driven Front Auxiliary Drive	88____	Oil Filter
43____	Starting Aid	91____	Special Equipment (Factory Installed)
44____	Timing Gear Cover with Gears	94____	Vehicle Timing
45____	Balancer Shaft	95____	Identification label
46____	Cylinder Block With Liners and Camshaft	97____	Special Equipment (Field Installed)
47____	Crankshaft and Bearings	98____	Shipping
48____	Connecting Rods and Pistons		
49____	Valve Actuating Mechanisms		

DPSG,CD03523,14 -19-22JAN07-2/2

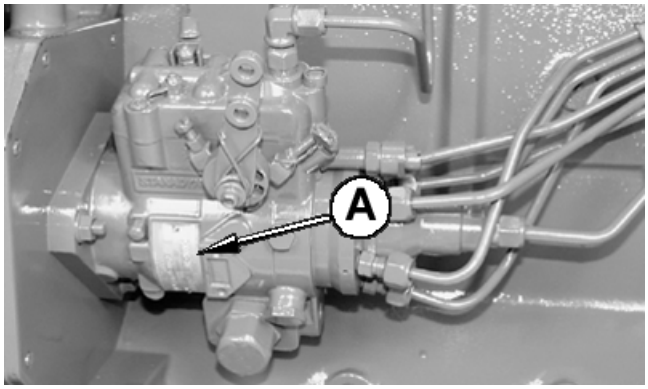
Record fuel injection pump model number

Record the fuel injection pump model and serial information found on the serial number plate (A).

Model No. _____ RPM _____

Manufacturer's No. _____

Serial No. _____



CD30749 —UN—24SEP99

DPSG,CD03523,15 -19-22JAN07-1/1

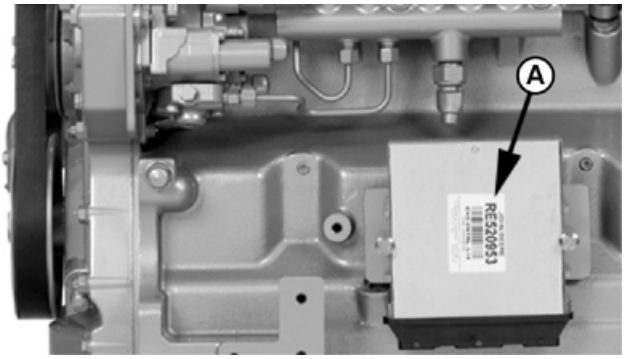
Record Engine Control Unit (ECU) Serial Number

Record the part number and serial number information found on the serial number label (A) on the Engine Control Unit (ECU) mounted on or near the engine.

Part No._____

Serial No._____

A—Serial Number Label



RG14635 —UN—13APR06

Record Engine Control Unit (ECU) Serial Number

CD03523,0000189 -19-06FEB07-1/1

Record High-Pressure Fuel Pump Model Number

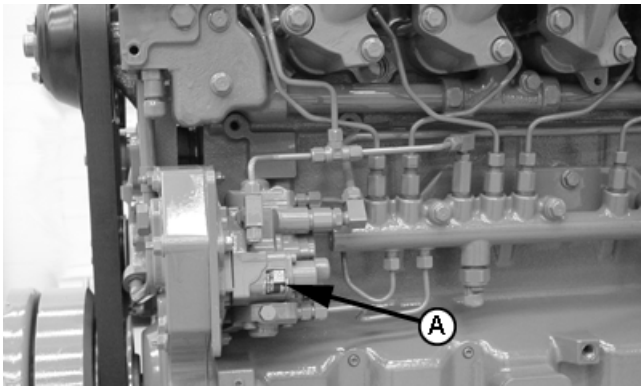
Record the high-pressure fuel pump model and serial number information found on the serial number plate (A).

Model No._____ RPM_____

Manufacturer's No._____

Serial No._____

A—Serial Number Plate



RG13718 —UN—11NOV04

Record High-Pressure Fuel Pump Serial Number

CD03523,000018A -19-06FEB07-1/1

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.

T81389 —UN—07DEC88

DX,ALERT -19-29SEP98-1/1

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

TS187 —19—30SEP88

DX,SIGNAL -19-03MAR93-1/1

Do Not Open High-Pressure Fuel System

High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair of fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system.

Only technicians familiar with this type of system can perform repairs. (See your John Deere dealer.)

TS1343 —UN—18MAR92

DX,WW,HPCR1 -19-07JAN03-1/1

Engine lifting procedure

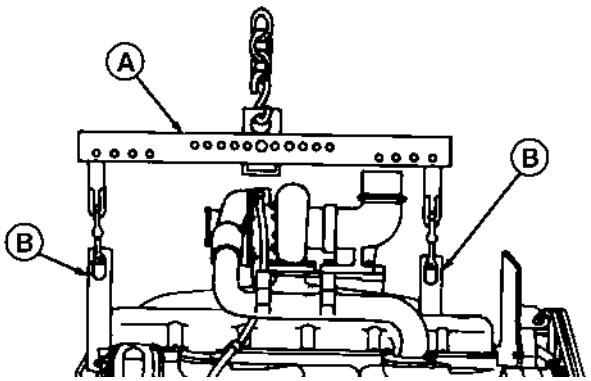
CAUTION: The only recommended method for lifting the engine is with JDG23 Engine Lifting Sling (A) and safety approved lifting straps (B) that come with engine. Use extreme caution when lifting and NEVER permit any part of the body to be positioned under an engine being lifted or suspended.

Lift engine with longitudinal loading on lifting sling and lifting straps only. Angular loading greatly reduces lifting capacity of sling and straps.

NOTE: If engine does not have lifting straps, universal straps can be procured through service parts under part numbers JD-244-1 and JD-244-2.

1. If not equipped, install lifting straps and torque to 200 N·m (145 lb-ft).
2. Attach JDG23 Engine Lifting Sling (A) to engine lifting straps (B) and overhead hoist.

IMPORTANT: Lifting straps are designed to lift the engine and accessories such as radiator, air filter and other small components. If larger components, such as power take-off, transmission, generator air compressor... etc, are attached to engine, the lifting straps provided with engine or through parts channel are not intended for this purpose. Technician is responsible for providing adequate lifting devices under these situations. See machine manuals for additional information on removing engine from machine.



RG7784 —UN—11NOV97

3. Carefully move engine to desired location.

DPSG,CD03523,95 -19-22JAN07-1/1

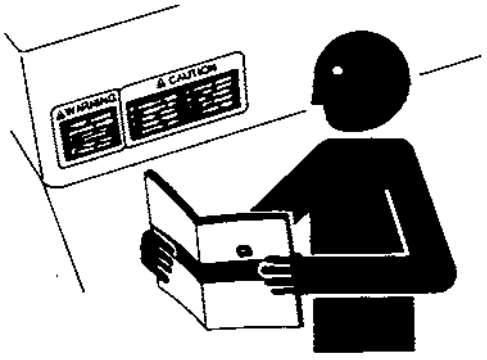
Follow Safety Instructions

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.



TS201 —UN—23AUG88

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.

DX,READ -19-16JUN09-1/1

Prevent Machine Runaway

Avoid possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.

TS177 —UN—11JAN89

DX,BYPAS1 -19-29SEP98-1/1

Handle Fuel Safely—Avoid Fires

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine. Fill fuel tank outdoors.

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.

TS202 —UN—23AUG88

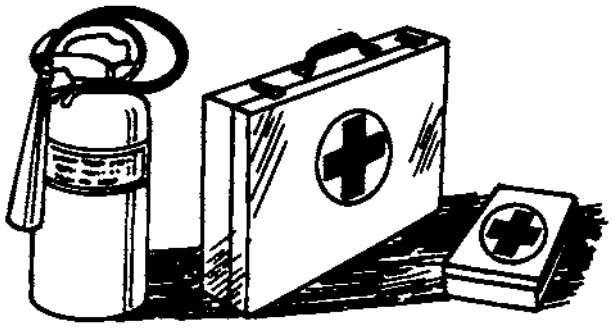
DX,FIRE1 -19-03MAR93-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 —UN—23AUG88

DX,FIRE2 -19-03MAR93-1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

Keep all sparks and flame away when using it. Keep starting fluid away from batteries and cables.

To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location.

Do not incinerate or puncture a starting fluid container.

TS1356 —UN—18MAR92

DX,FIRE3 -19-16APR92-1/1

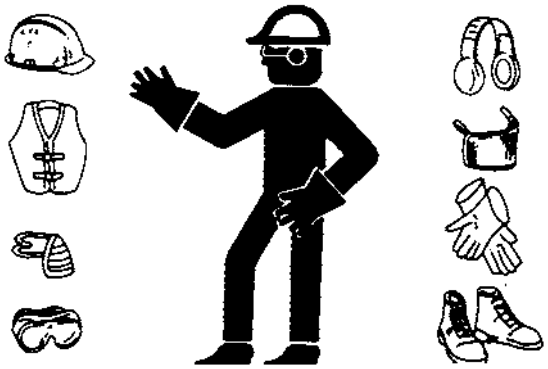
Wear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



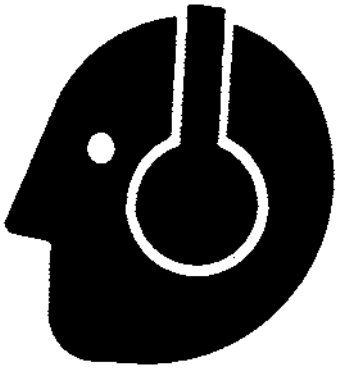
TS206 —UN—23AUG88

DX,WEAR -19-10SEP90-1/1

Protect Against Noise

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



TS207 —UN—23AUG88

DX,NOISE -19-03MAR93-1/1

Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)

TS1132 —UN—26NOV90

DX,MSDS,NA -19-03MAR93-1/1

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close fitting clothing. Stop the engine and be sure the PTO driveline is stopped before making adjustments or performing any type service on the engine or PTO-driven equipment.

TS1644 —UN—22AUG95

CD,PTO -19-22JAN07-1/1

Practice Safe Maintenance

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.

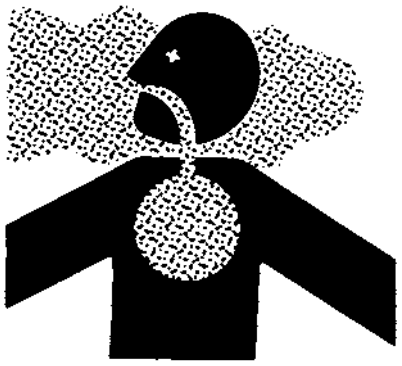
TS218 —UN—23AUG88

DX,SERV -19-17FEB99-1/1

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



TS220 —UN—23AUG88

DX,AIR -19-17FEB99-1/1

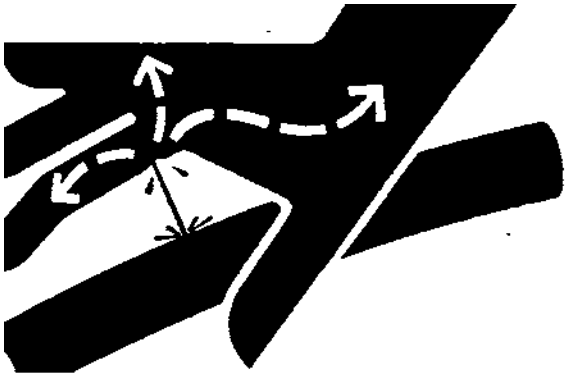
Avoid High-Pressure Fluids

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.



X9811 —UN—23AUG88

DX,FLUID -19-03MAR93-1/1

Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when heat goes beyond the immediate flame area.

TS953 —UN—15MAY90

DX,TORCH -19-10DEC04-1/1

Remove Paint Before Welding or Heating

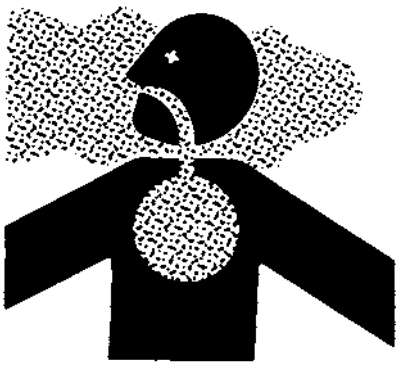
Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Do not use a chlorinated solvent in areas where welding will take place.



TS220 —UN—23AUG88

Do all work in an area that is well ventilated to carry toxic fumes and dust away.

Dispose of paint and solvent properly.

DX,PAINT -19-24JUL02-1/1

Service Cooling System Safely

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

TS281 —UN—23AUG88

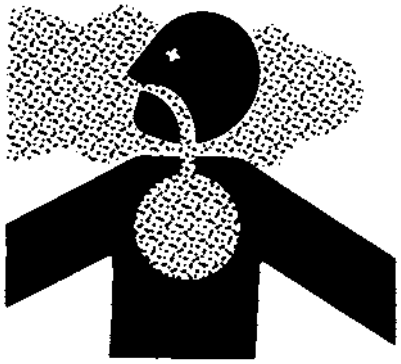
DX,RCAP -19-04JUN90-1/1

Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.



TS220 —UN—23AUG88

Keep bystanders away from the area.

DX,DUST -19-15MAR91-1/1

Dispose of Waste Properly

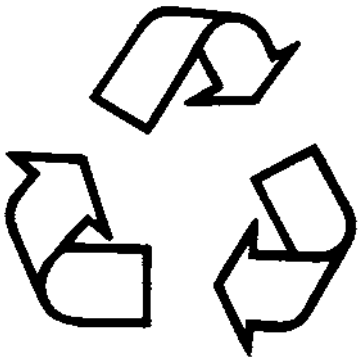
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



TS1133 —UN—26NOV90

DX,DRAIN -19-03MAR93-1/1

Diesel Fuel

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to EN 590 or ASTM D975 are recommended. Renewable diesel fuel produced by hydrotreating animal fats and vegetable oils is basically identical to petroleum diesel fuel. Renewable diesel that meets EN 590 or ASTM D975 is acceptable for use at all percentage mixture levels.

Required Fuel Properties

In all cases, the fuel shall meet the following properties:

Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially for temperatures below –20°C (–4°F) or elevations above 1500 m (5000 ft).

Cold Filter Plugging Point (CFPP) should be at least 5°C (9°F) below the expected lowest temperature or **Cloud Point** below the expected lowest ambient temperature.

Fuel lubricity should pass a maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156-1.

Sulfur Content for Interim Tier 4 and EU Stage IIIB Engines

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use ONLY ultra low sulfur diesel (ULSD) fuel with a maximum of 0.0015% (15 ppm) sulfur content.

Sulfur Content for Other Engines

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use of diesel fuel with sulfur content less than 0.10% (1000 ppm) is STRONGLY recommended.
- Use of diesel fuel with sulfur content 0.10% (1000 ppm) to 0.50% (5000 ppm) may result in REDUCED oil and filter change intervals. Refer to table in Diesel Engine Oil and Filter Service Intervals.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 ppm), contact your John Deere dealer.

IMPORTANT: Do not mix used diesel engine oil or any other type of lubricating oil with diesel fuel.

Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

DX,FUEL1 -19-28APR09-1/1

Handling and Storing Diesel Fuel

CAUTION: Handle fuel carefully. Do not fill the fuel tank when engine is running.

DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.

Keep all storage tanks as full as practicable to minimize condensation.

Ensure that all fuel tank caps and covers are installed properly to prevent moisture from entering.

Monitor water content of the fuel regularly.

When using bio-diesel fuel, the fuel filter may require more frequent replacement due to premature plugging.

Check engine oil level daily prior to starting engine. A rising oil level may indicate fuel dilution of the engine oil.

IMPORTANT: The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier for recommendations.

DX,FUEL4 -19-19DEC03-1/1

Diesel Engine Break-In Oil

New engines are filled at the factory with John Deere ENGINE BREAK-IN OIL. During the break-in period, add John Deere ENGINE BREAK-IN OIL as needed to maintain the specified oil level.

Change the oil and filter after the first 100 hours of operation of a new or rebuilt engine.

After engine overhaul, fill the engine with John Deere ENGINE BREAK-IN OIL.

If John Deere ENGINE BREAK-IN OIL is not available, use a diesel engine oil meeting one of the following during the first 100 hours of operation:

- API Service Classification CE
- API Service Classification CD
- API Service Classification CC
- ACEA Oil Sequence E2
- ACEA Oil Sequence E1

PLUS-50 is a trademark of Deere & Company.

After the break-in period, use John Deere PLUS-50 ™ or other diesel engine oil as recommended in this manual.

IMPORTANT: Do not use PLUS-50 oil or engine oils meeting any of the following during the first 100 hours of operation of a new or rebuilt engine:

API CJ-4	**ACEA E7**
API CI-4 PLUS	**ACEA E6**
API CI-4	**ACEA E5**
API CH-4	**ACEA E4**
API CG-4	**ACEA E3**
API CF-4	
API CF-2	
API CF	

These oils will not allow the engine to break-in properly.

DX,ENOIL4 -19-13SEP06-1/1

Diesel Engine Oil

Use oil viscosity based on the expected air temperature range during the period between oil changes.

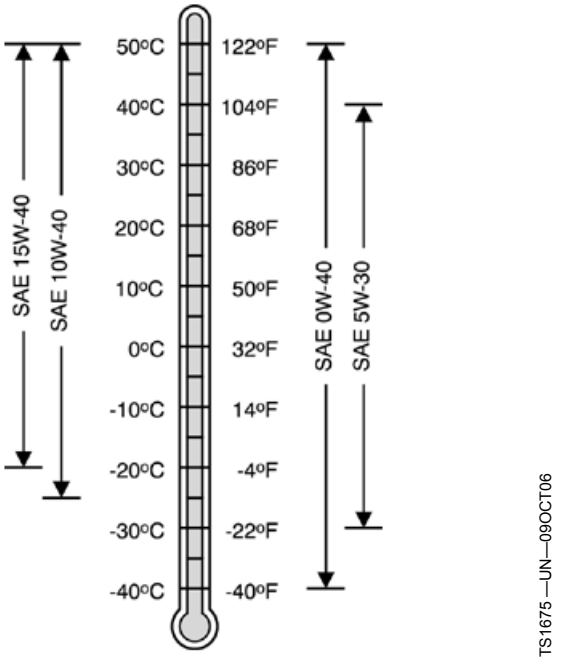
Depending on Emission Regulation requirements, the oil recommendations are different. Refer to the chart to identify the proper oil to be used.

Non Emission Certified Engines and Stage II or EPA Tier 2 Emission Certified Engines	EPA Tier 3 Emission Certified Engines
John Deere PLUS-50™ (Preferred)	John Deere PLUS-50™ (Preferred)
ACEA-E7, ACEA-E6, ACEA-E5, ACEA-E4	ACEA-E7, ACEA-E6

Multi-viscosity diesel engine oils are preferred.

If diesel fuel with sulfur content greater than 0.5% is used or if oil does not meet the classification above, reduce the service interval by 50%.

DO NOT use diesel fuel with sulfur content greater than 1%.



Oil Viscosities for Air Temperature Ranges

PLUS-50 is a trademark of Deere & Company

CD,ENOIL -19-01JUL09-1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST -19-18MAR96-1/1

Mixing of Lubricants

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

DX,LUBMIX -19-18MAR96-1/1

Diesel Engine Coolant

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F).

John Deere COOL-GARD is preferred for service.

If John Deere COOL-GARD is not available, use a low silicate ethylene glycol or propylene glycol base coolant concentrate in a 50% mixture of concentrate with quality water.

The coolant concentrate shall be of a quality that provides cavitation protection to cast iron and aluminum parts in the cooling system. John Deere COOL-GARD meets this requirement.

Freeze protection

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F).

A 50% mixture of propylene glycol engine coolant in water provides freeze protection to -33°C (-27°F).

If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

Water quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

IMPORTANT: Do not mix ethylene glycol and propylene glycol base coolants.

DX,COOL8 -19-16NOV01-1/1

Operating in Warm Temperature Climates

John Deere engines are designed to operate using glycol base engine coolants.

Always use a recommended glycol base engine coolant, even when operating in geographical areas where freeze protection is not required.

John Deere COOL-GARD™ II Premix is available in a concentration of 50% ethylene glycol. However, there are situations in warm temperature climates where a coolant with lower glycol concentration (approximately 20% ethylene glycol) has been approved. In these cases, the low glycol formulation has been modified to provide the same level of corrosion inhibitor as John Deere COOL-GARD II Premix (50/50).

COOL-GARD is a trademark of Deere & Company

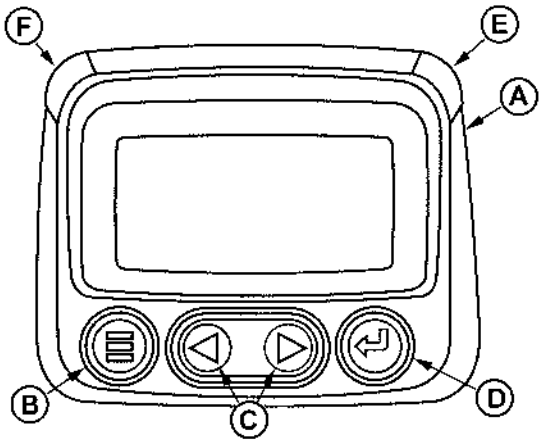
IMPORTANT: Water may be used as coolant *in emergency situations only.*

Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation will occur when water is used as the coolant, even when coolant conditioners are added.

Drain cooling system and refill with recommended glycol base engine coolant as soon as possible.

DX,COOL6 -19-03NOV08-1/1

Using Diagnostic Gauge to Access Engine Information (Optional equipment)



RG13132 —UN—09SEP03

Diagnostic Gauge

A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Enter Key
E—Red "STOP ENGINE" Indicator Light
F—Amber "WARNING" Indicator Light

NOTE: Generator sets powered by an electronically controlled engine (DE10 or HPCR fuel system) can be optionally equipped with the diagnostic gauge shown. Depending on the generator set manufacturer, other instrumentations can be used. Refer to the generator set documentation for more information.

The diagnostic gauge (A) allows the operator to view many readouts of engine functions and trouble codes (DTCs). The gauge is linked to the electronic control system and its sensors. This allows the operator to monitor engine functions and to troubleshoot the engine systems when needed.

Press the menu key (B) to access the various engine functions in sequence. The displays can be selected as either customary English or metric units. The following menu of engine parameters can be displayed on the diagnostic gauge window:

- Engine hours
- Engine rpm
- System voltage
- Percent engine load at the current rpm
- Coolant temperature
- Oil pressure
- Throttle position
- Intake manifold temperature
- Current fuel consumption
- Active service (diagnostic) codes
- Stored service (diagnostic) codes from the engine
- Set the units for display
- View the engine configuration parameters

NOTE: Engine parameters which can be accessed will vary with the engine application. Six languages for readouts are available and can be selected during setup of gauge.

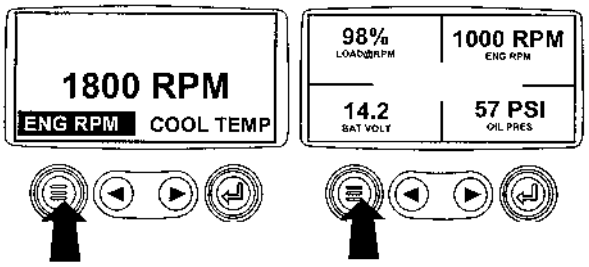
The diagnostic gauge includes a graphical backlit Liquid Crystal Display (LCD) screen. The display can show either a single parameter or a quadrant display showing four parameters simultaneously. The diagnostic gauge uses two arrow keys (C) for scrolling through the engine parameter list and viewing the menu list and an enter key (D) for selecting highlighted items. The red (E) and amber (F) lights are used to signal active trouble code received by the diagnostic gauge.

CD03523,000018B -19-22JAN07-1/1

Main Menu Navigation

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



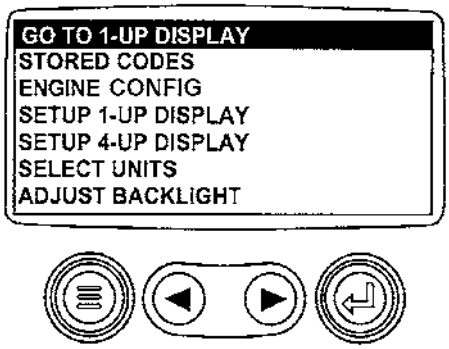
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000A9 -19-03SEP03-1/5

2. The first seven items of the "Main Menu" will be displayed.

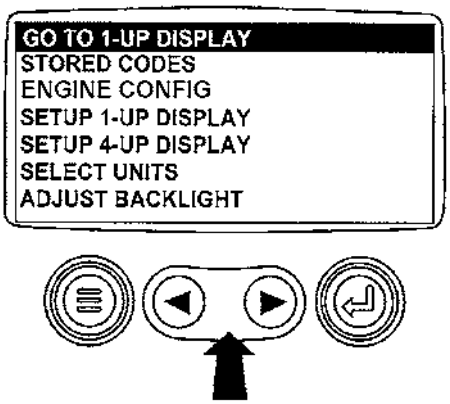


RG13160 —UN—02OCT03

Menu Display

OURGP11,00000A9 -19-03SEP03-2/5

3. Pressing the "Arrow" keys will scroll through the menu selections.

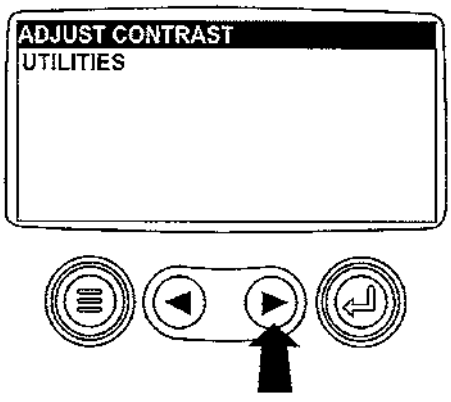


RG13161 —UN—02OCT03

Main Menu Items

OURGP11,00000A9 -19-03SEP03-3/5

4. Pressing the right arrow key will scroll down to reveal the last items of "Main Menu" screen, highlighting the next item down.



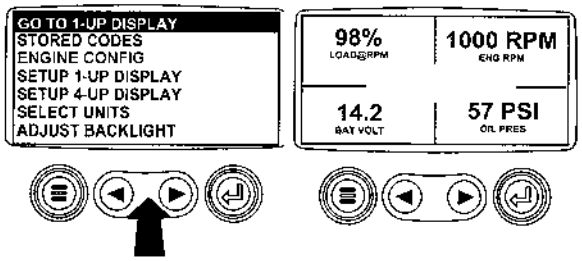
RG13162 —UN—26SEP03

Last Items On Main Menu

Continued on next page

OURGP11,00000A9 -19-03SEP03-4/5

5. Use the arrow keys to scroll to the desired menu item or press the "Menu Button" to exit the main menu and return to the engine parameter display.



RG13163 —UN—02OCT03

Use Arrow Buttons To Scroll / Quadrant Display

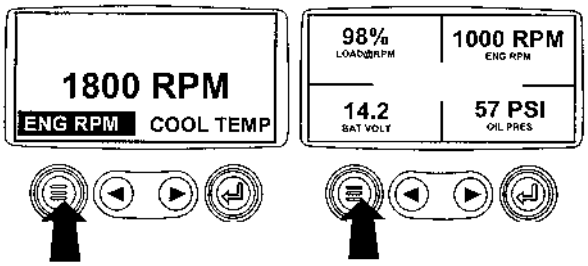
OURGP11,00000A9 -19-03SEP03-5/5

Engine Configuration Data

NOTE: The engine configuration data is a read only function.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

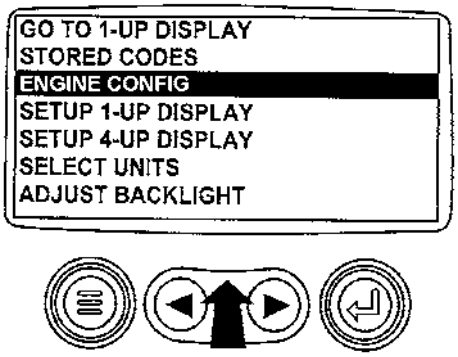


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000AB -19-03SEP03-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Engine Config" is highlighted.



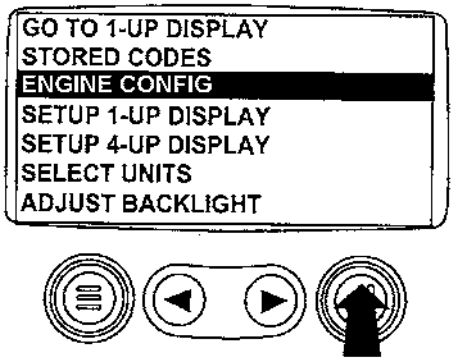
RG13164 —UN—07OCT03

Select Engine Configuration

Continued on next page

OURGP11,00000AB -19-03SEP03-2/6

3. Once "Engine Config" menu item has been highlighted, press the "Enter" key to view the engine configuration data.

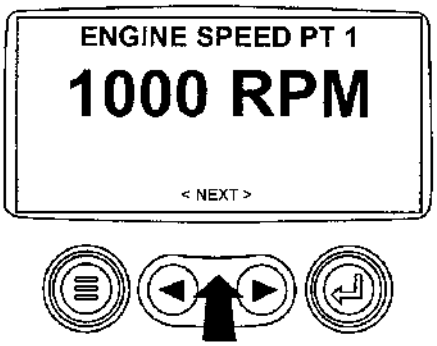


RG13165 —UN—02OCT03

Enter Key

OURGP11,00000AB -19-03SEP03-3/6

4. Use the "Arrow" keys to scroll through the engine configuration data.

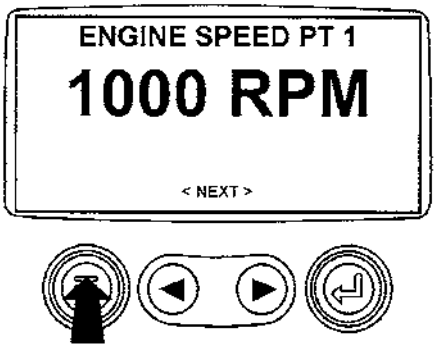


RG13166 —UN—29SEP03

Use Arrow Keys To Scroll

OURGP11,00000AB -19-03SEP03-4/6

5. Press the "Menu" key to return to the main menu.



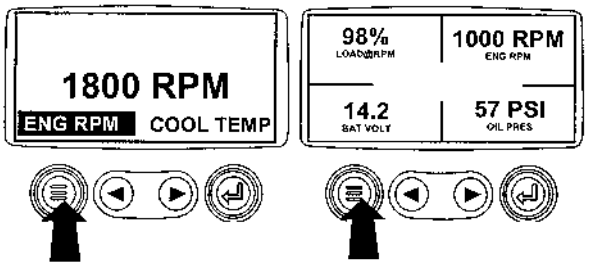
RG13167 —UN—29SEP03

Return To Main Menu

Continued on next page

OURGP11,00000AB -19-03SEP03-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



Exit Main Menu

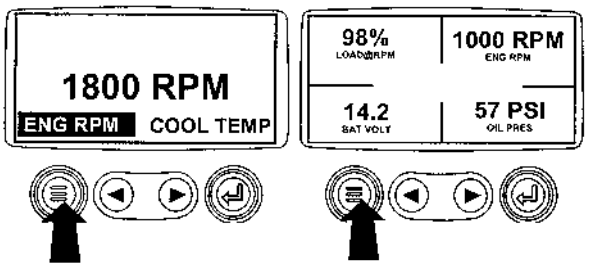
OURGP11,00000AB -19-03SEP03-6/6

Accessing Stored Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.

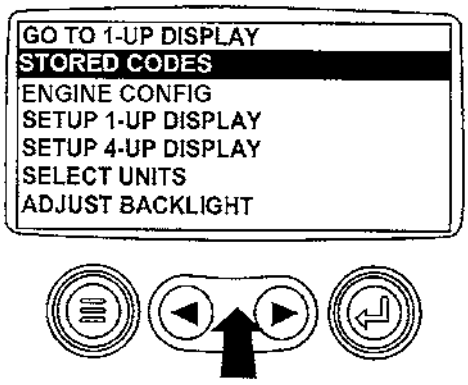
1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



Menu Key

OURGP11,00000AC -19-03SEP03-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Stored Codes" is highlighted.

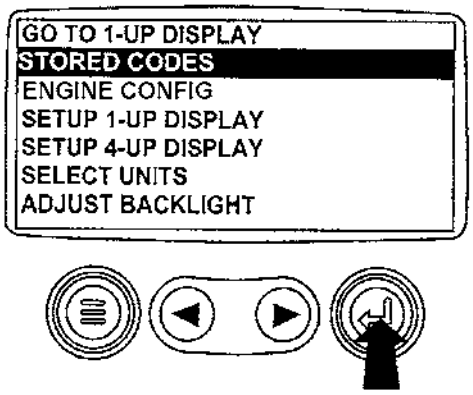


Select Stored Codes

Continued on next page

OURGP11,00000AC -19-03SEP03-2/6

3. Once the "Stored Codes" menu item has been highlighted press the "Enter" key to view the stored codes.

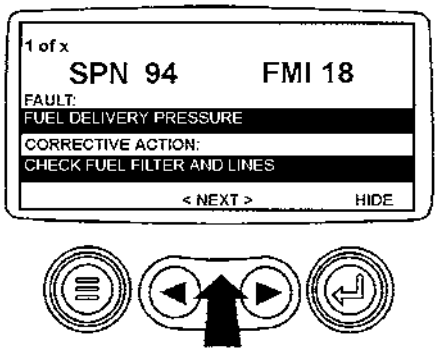


RG13169 —UN—02OCT03

Enter Key

OURGP11,00000AC -19-03SEP03-3/6

4. If the word "Next" appears above the "Arrow" keys, there are more stored codes that may be viewed. Use the "Arrow" key to scroll to the next stored code.

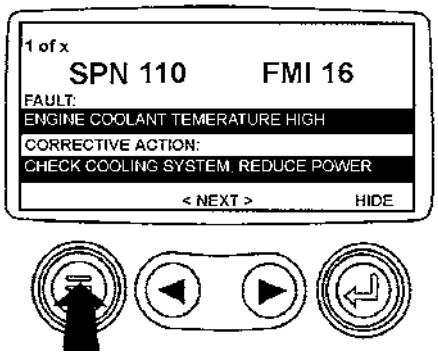


RG13245 —UN—02OCT03

Use Arrow Keys To Scroll

OURGP11,00000AC -19-03SEP03-4/6

5. Press the "Menu" key to return to the main menu.



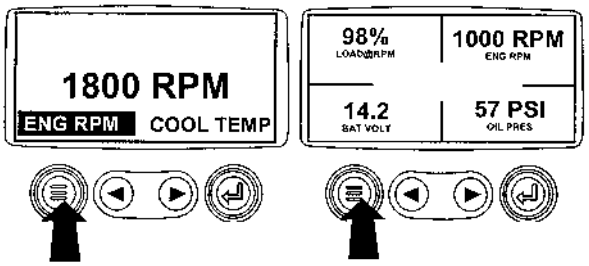
RG13246 —UN—02OCT03

Return To Main Menu

Continued on next page

OURGP11,00000AC -19-03SEP03-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



RG13159 —UN—26SEP03

Exit Main Menu

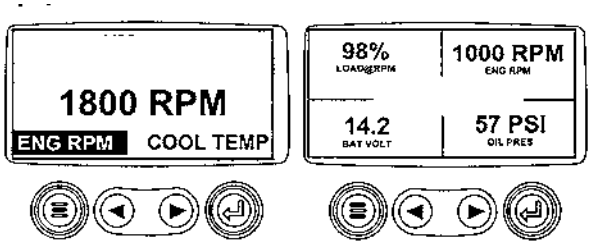
OURGP11,00000AC -19-03SEP03-6/6

Accessing Active Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.

1. During normal operation the single or four parameter screen will be displayed.



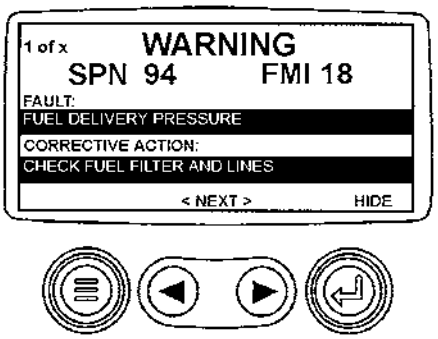
RG13172 —UN—26SEP03

Normal Operation

OURGP11,00000AD -19-03SEP03-1/7

2. When the diagnostic gauge receives a trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Warning" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

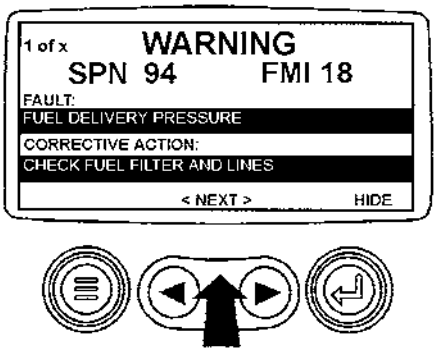


RG13240 —UN—30SEP03

Active Trouble Codes Displayed

OURGP11,00000AD -19-03SEP03-2/7

3. If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.



RG13241 —UN—30SEP03

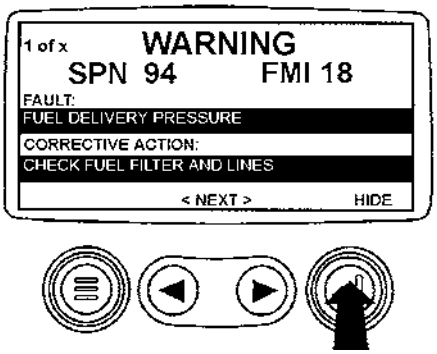
Use Arrow Keys To Scroll

Continued on next page

OURGP11,00000AD -19-03SEP03-3/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

4. To acknowledge and hide the code and return to the single or four parameter display, press the "Enter" Key.

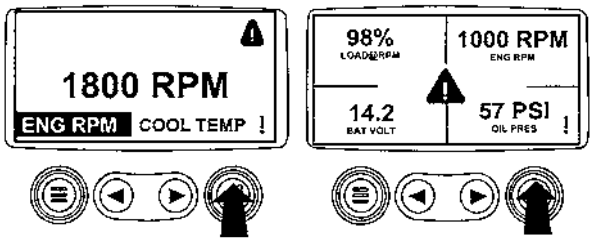


RG13242 —UN—30SEP03

Hide Trouble Codes

OURGP11,00000AD -19-03SEP03-4/7

5. The display will return to the single or four parameter display, but the display will contain the warning icon. Pressing the "Enter" key will redisplay the hidden trouble code.



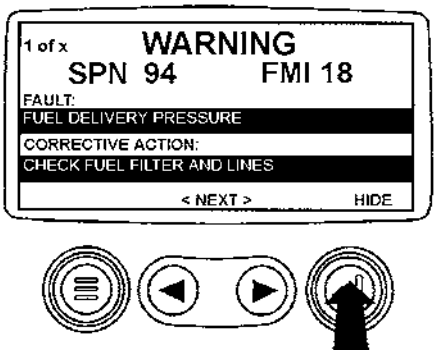
RG13176 —UN—26SEP03

Active Trouble Code Icon

OURGP11,00000AD -19-03SEP03-5/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

6. Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.

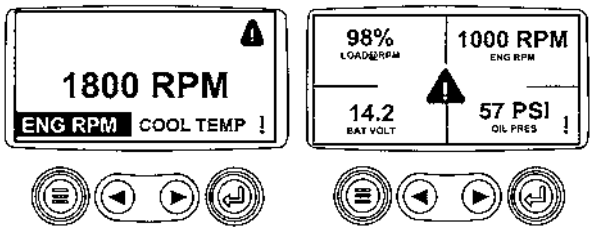


RG13242 —UN—30SEP03

Enter Key

OURGP11,00000AD -19-03SEP03-6/7

7. The single or four parameter screen will display the warning icon until the trouble code condition is corrected.



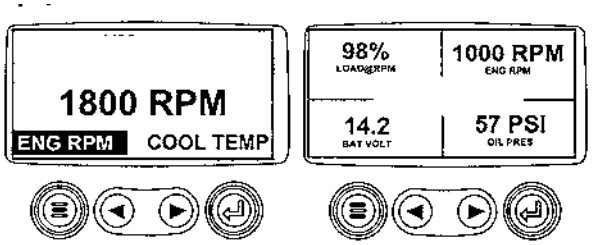
RG13243 —UN—01OCT03

Active Trouble Code Condition

OURGP11,00000AD -19-03SEP03-7/7

Engine Shutdown Codes

1. During normal operation the single or four parameter screen will be displayed.



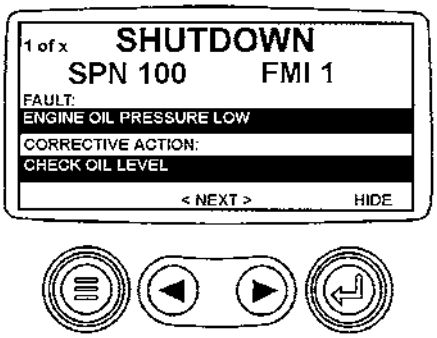
RG13172 —UN—26SEP03

Normal Operation

OURGP11,00000AE -19-03SEP03-1/6

2. When the diagnostic gauge receives a severe trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Shutdown" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

   If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.



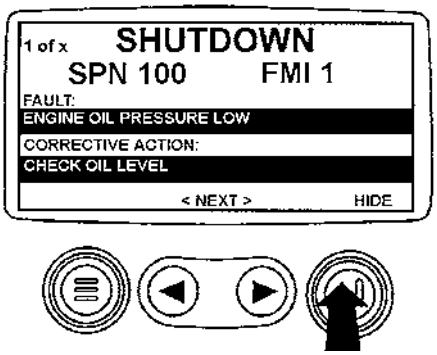
RG13238 —UN—29SEP03

Shutdown Message

OURGP11,00000AE -19-03SEP03-2/6

3. To acknowledge and hide the trouble code and return to the single or four parameter display, press the "Enter" key".

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



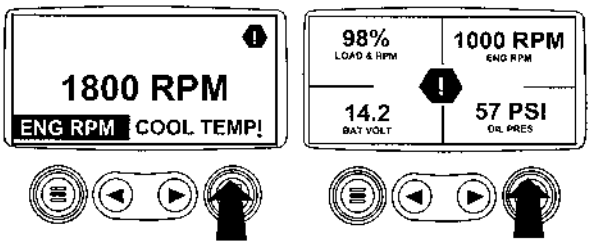
RG13239 —UN—29SEP03

Hide Trouble Code

OURGP11,00000AE -19-03SEP03-3/6

4. The display will return to the single or four parameter display, but the display will contain the "Shutdown" icon. Pressing the "Enter" key will redisplay the hidden trouble code.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



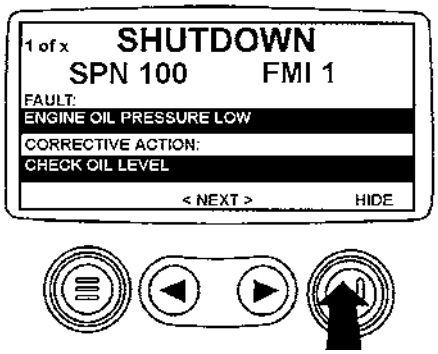
RG13179 —UN—26SEP03

Flashing Shutdown Icon

Continued on next page

OURGP11,00000AE -19-03SEP03-4/6

5. Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.



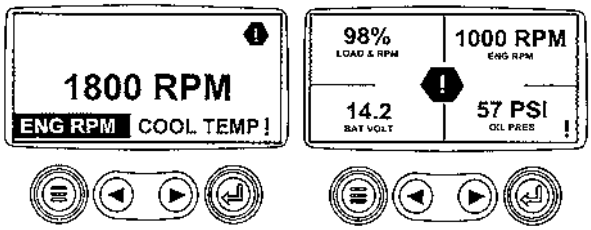
RG13239 —UN—29SEP03

Redisplay Trouble Code

OURGP11,00000AE -19-03SEP03-5/6

6. The single or four parameter screen will display the shutdown icon until the trouble code condition is corrected.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



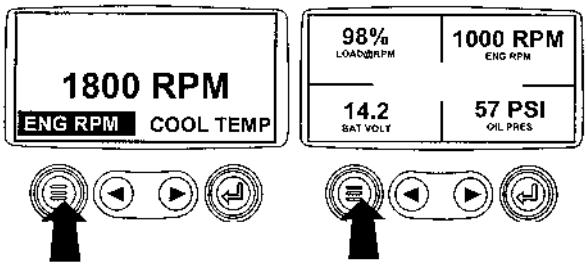
RG13180 —UN—26SEP03

Shutdown Icon

OURGP11,00000AE -19-03SEP03-6/6

Adjusting Backlighting

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

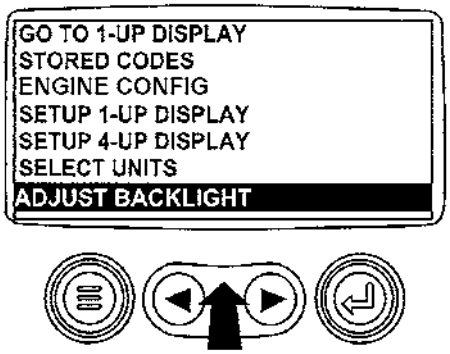


RG13159 —UN—26SEP03

Menu Key

OURGP11,0000237 -19-21OCT03-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Backlight" is highlighted.



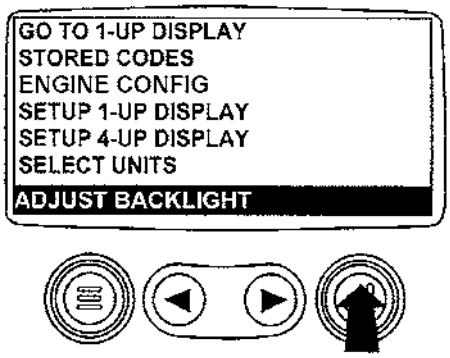
RG13181 —UN—02OCT03

Select Adjust Backlight

Continued on next page

OURGP11,0000237 -19-21OCT03-2/6

3. Once the "Adjust Backlight" menu item has been highlighted, press the "Enter" key to activate the "Adjust Backlight" function.

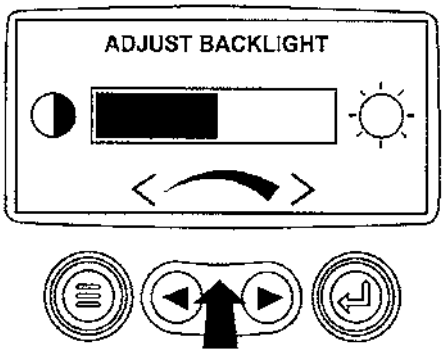


RG13182 —UN—02OCT03

Press Enter Key

OURGP11,0000237 -19-21OCT03-3/6

4. Use the "Arrow" keys to select the desired backlight intensity.

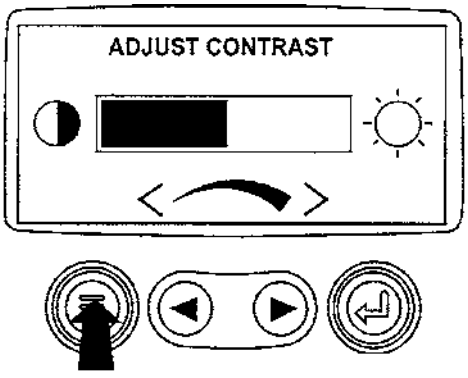


RG13183 —UN—29SEP03

Adjust Backlight Intensity

OURGP11,0000237 -19-21OCT03-4/6

5. Press the "Menu" key to return to the main menu.



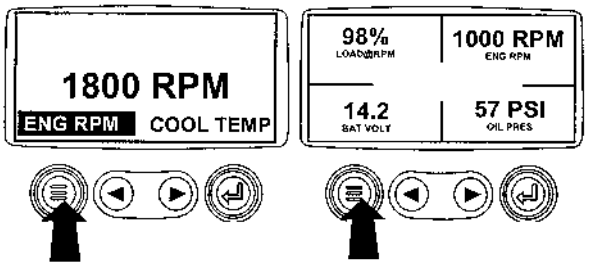
RG13184 —UN—26SEP03

Return To Main Menu

Continued on next page

OURGP11,0000237 -19-21OCT03-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



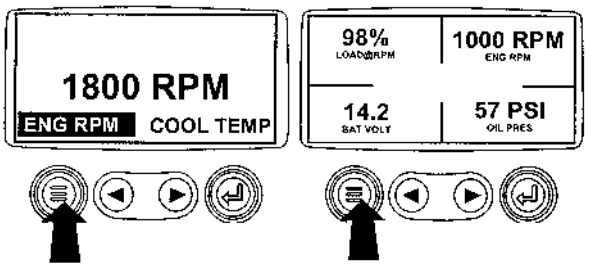
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,0000237 -19-21OCT03-6/6

Adjusting Contrast

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display press the "Menu" key.

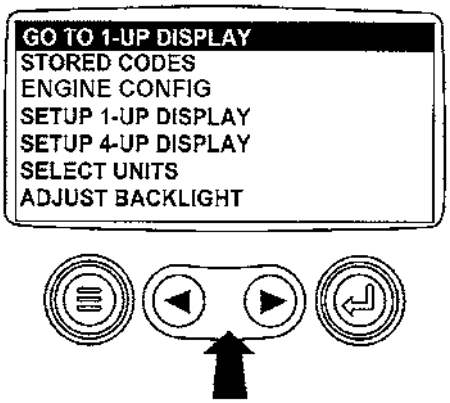


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000AF -19-03SEP03-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Contrast" is highlighted.

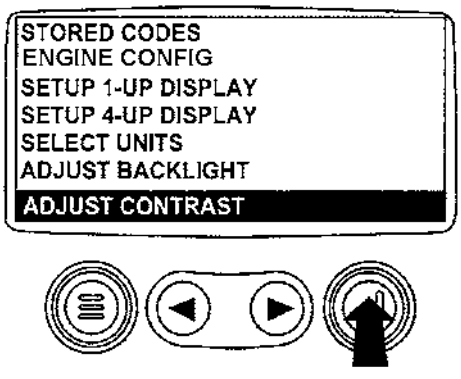


RG13161 —UN—02OCT03

Select Adjust Contrast

OURGP11,00000AF -19-03SEP03-2/6

3. Once the "Adjust Contrast" menu item has been highlighted, press the "Enter" key to activate the "Adjust Contrast" function.



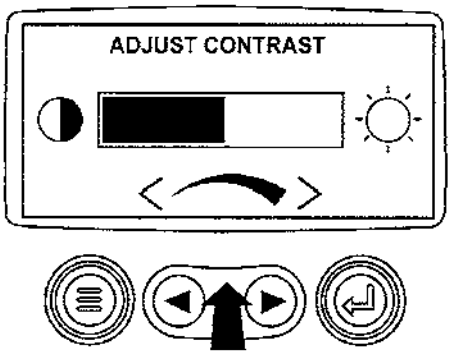
RG13185 —UN—02OCT03

Press Enter Key

Continued on next page

OURGP11,00000AF -19-03SEP03-3/6

4. Use the "Arrow" keys to select the desired contrast intensity.

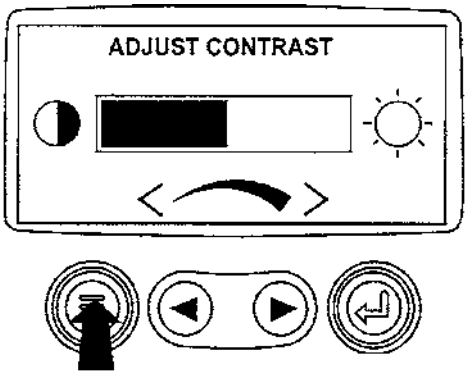


RG13186 —UN—29SEP03

Adjust Contrast Intensity

OURGP11,00000AF -19-03SEP03-4/6

5. Press the "Menu" key to return to the main menu.

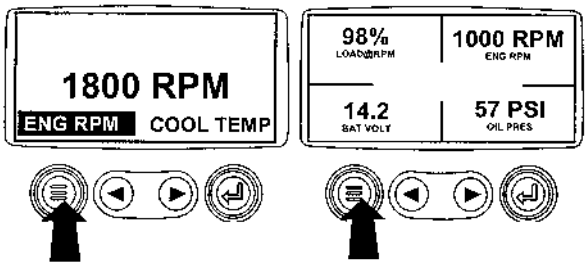


RG13187 —UN—26SEP03

Return To Main Menu

OURGP11,00000AF -19-03SEP03-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



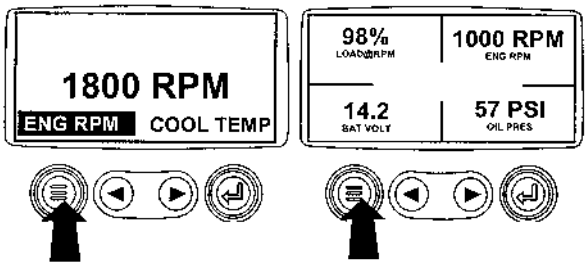
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,00000AF -19-03SEP03-6/6

Selecting Units Of Measurement

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



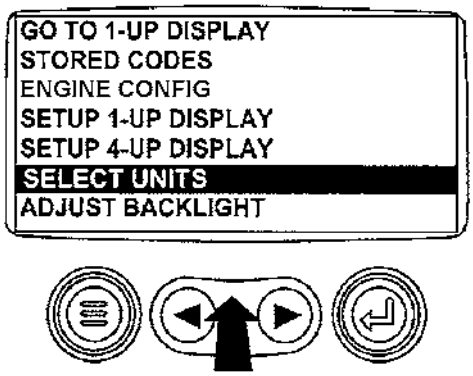
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000B0 -19-03SEP03-1/7

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Select Units" is highlighted.

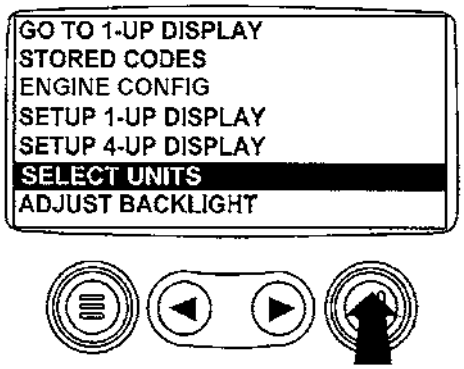


RG13188 —UN—02OCT03

Select Units

OURGP11,00000B0 -19-03SEP03-2/7

3. Once the "Select Units" menu item has been highlighted press the "Enter" key to access the "Select Units" function.



RG13189 —UN—02OCT03

Press Enter Key

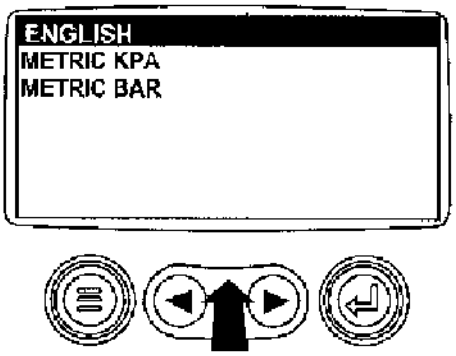
OURGP11,00000B0 -19-03SEP03-3/7

4. There are three choices for units of measurement, English, Metric kPa or Metric Bar.

   English is for Imperial units, with pressures displayed in PSI and temperatures in °F.

   Metric kPa and Metric bar are for IS units, with pressures displayed in kPa and bar respectively, and temperatures in °C.

   Use the "Arrow" keys to highlight the desired units of measurement.



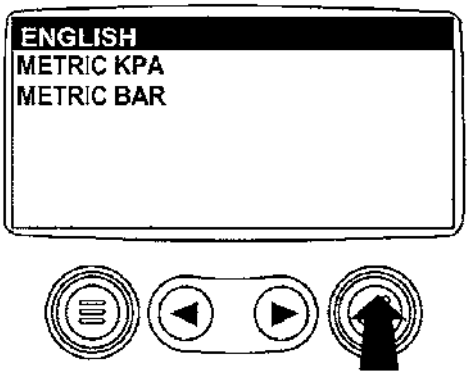
RG13190 —UN—26SEP03

Select Desired Units

Continued on next page

OURGP11,00000B0 -19-03SEP03-4/7

5. Press the "Enter" key to select the highlighted units.

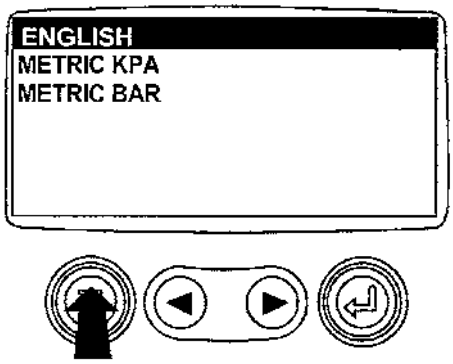


RG13191 —UN—30SEP03

Press Enter Key to Select

OURGP11,00000B0 -19-03SEP03-5/7

6. Press the "Menu" key to return to the main menu.

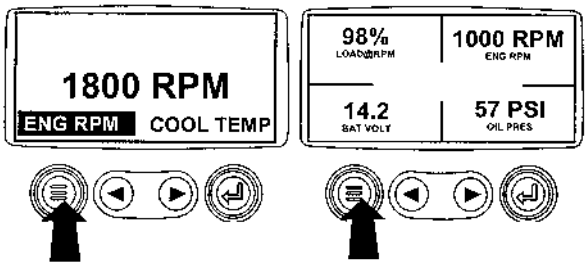


RG13192 —UN—26SEP03

Return To Main Menu

OURGP11,00000B0 -19-03SEP03-6/7

7. Press the "Menu" key to return to the engine parameter display.



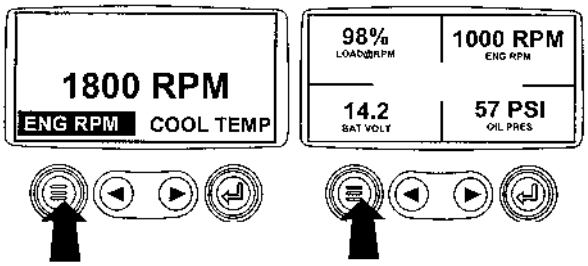
RG13159 —UN—26SEP03

Press Menu Key

OURGP11,00000B0 -19-03SEP03-7/7

Setup 1-Up Display

1. Turn the key switch to the ON position. Starting at the single engine parameter display, press the "Menu" key.



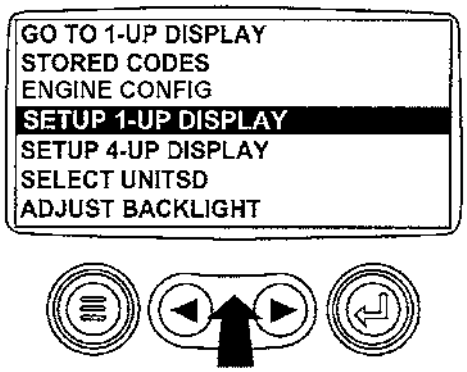
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000B1 -19-03SEP03-1/18

2. Use the "Arrow" keys to scroll through the menu until "Setup 1-Up Display" is highlighted.

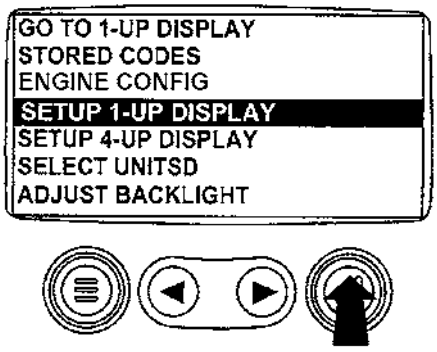


RG13193 —UN—02OCT03

Setup 1-Up Display

OURGP11,00000B1 -19-03SEP03-2/18

3. Once "Setup 1-Up Display" menu item has been highlighted press the "Enter" key to access the "Setup 1-Up Display" function.

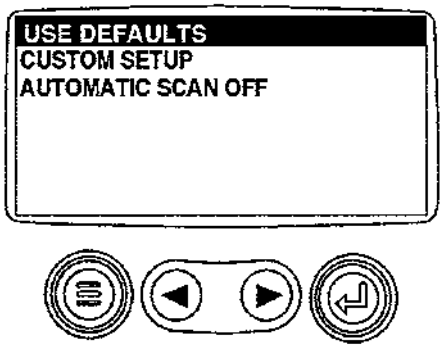


RG13194 —UN—02OCT03

Press Enter Key

OURGP11,00000B1 -19-03SEP03-3/18

4. Three options are available for modification of the 1-Up Display.
   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Hours, Engine Speed, Battery Voltage, % Load, Coolant Temperature and Oil Pressure.
   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters. This option can be used to add parameters available for scrolling in the 1-Up Display.
   c. **Automatic Scan** – Selecting the scan function will allow the 1-Up Display to scroll through the selected set of parameters one at a time, momentarily pausing at each.



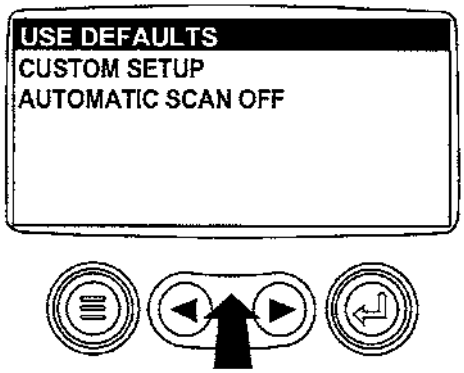
RG13196 —UN—26SEP03

1-Up Display Options

Continued on next page

OURGP11,00000B1 -19-03SEP03-4/18

5. **Use Defaults** - To select "Use Defaults" use the Arrow keys to scroll to and highlight "Use Defaults" in the menu display.

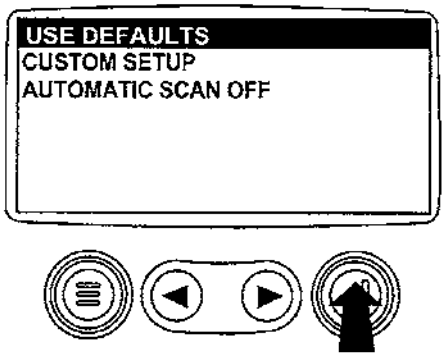


RG13195 —UN—26SEP03

Select Defaults

OURGP11,00000B1 -19-03SEP03-5/18

6. Press the "Enter" key to activate the "Use Defaults" function.

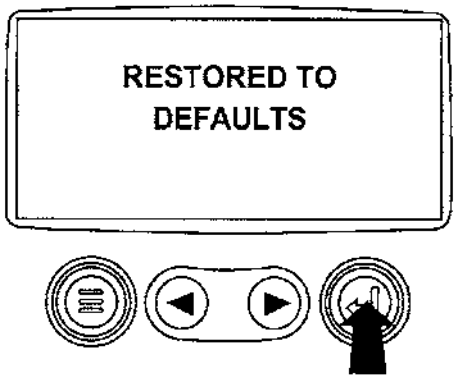


RG13197 —UN—29SEP03

Defaults Selected

OURGP11,00000B1 -19-03SEP03-6/18

7. The display parameters are reset to the factory defaults, then the display will return to the "Setup 1-Up Display" menu.



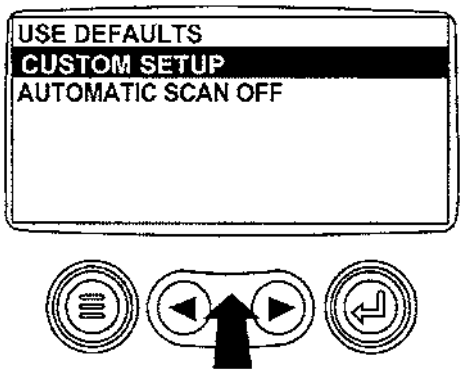
RG13149 —UN—24SEP03

Restored To Defaults

Continued on next page

OURGP11,00000B1 -19-03SEP03-7/18

8. **Custom Setup** - To perform a custom setup of the 1-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

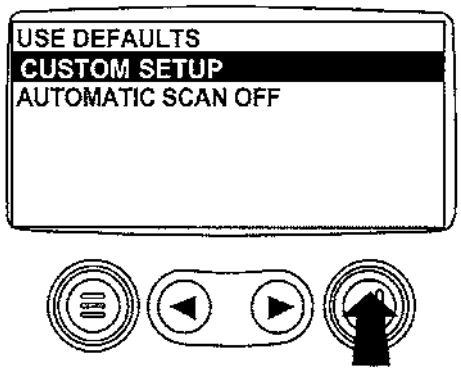


RG13198 —UN—26SEP03

Select Custom Setup

OURGP11,00000B1 -19-03SEP03-8/18

9. Press the "Enter" key to display a list of engine parameters.

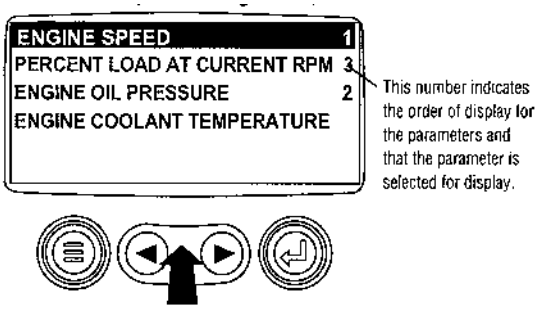


RG13199 —UN—26SEP03

Engine Parameters

OURGP11,00000B1 -19-03SEP03-9/18

10. Use the "Arrow" keys to scroll to and highlight a selected parameter (parameter with a number to right of it).


ENGINE SPEED 1
PERCENT LOAD AT CURRENT RPM 3
ENGINE OIL PRESSURE 2
ENGINE COOLANT TEMPERATURE
This number indicates the order of display for the parameters and that the parameter is selected for display.

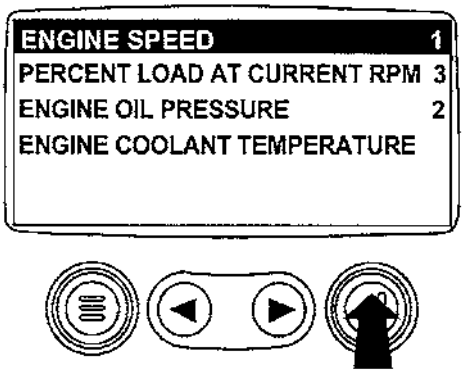
RG13150 —UN—24SEP03

Select Parameters

Continued on next page

OURGP11,00000B1 -19-03SEP03-10/18

11. Press the "Enter" key to deselect the selected parameter, removing it from the list of parameters being displayed on the 1-Up Display.

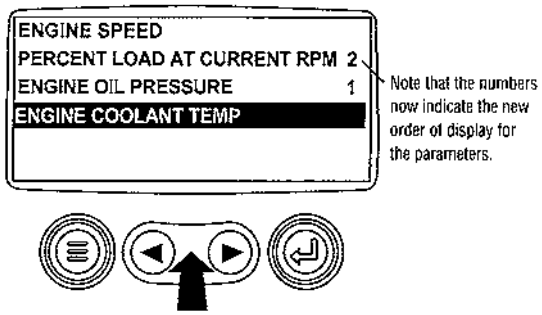


RG13219 —UN—26SEP03

Deselect Parameters

OURGP11,00000B1 -19-03SEP03-11/18

12. Use the "Arrow" keys to scroll and highlight the desired parameter that has not been selected for display (parameter without a number to right of it).

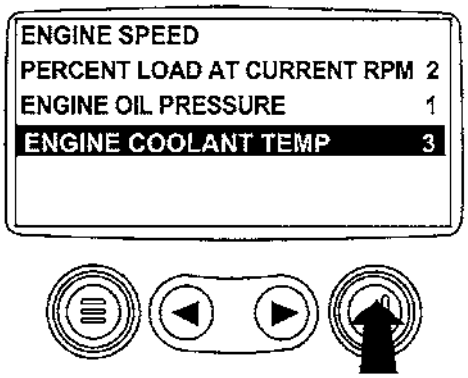

ENGINE SPEED
PERCENT LOAD AT CURRENT RPM 2
ENGINE OIL PRESSURE 1
ENGINE COOLANT TEMP
Note that the numbers now indicate the new order of display for the parameters.

RG13151 —UN—24SEP03

Select Desired Parameters

OURGP11,00000B1 -19-03SEP03-12/18

13. Press the "Enter" key to select the parameter for inclusion in the Single Engine Parameter Display.
14. Continue to scroll through and select additional parameters for the custom 1-Up Display. Press the "Menu" key at any time to return to the "Custom Setup" menu.



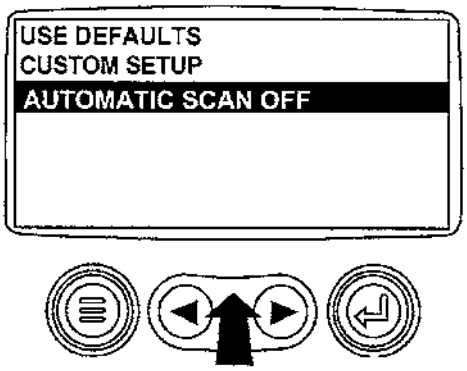
RG13220 —UN—26SEP03

Select Parameters For Display

Continued on next page

OURGP11,00000B1 -19-03SEP03-13/18

15. **Automatic Scan** - Selecting the scan function will allow the 1- Up Display to scroll through the selected set of parameters one at a time. Use the "Arrow" keys to scroll to the "Automatic Scan" function.

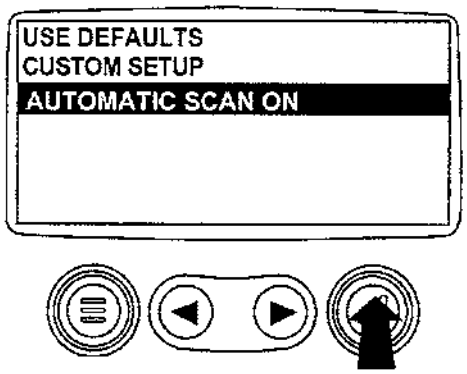


RG13221 —UN—26SEP03

Automatic Scan Off

OURGP11,00000B1 -19-03SEP03-14/18

16. Press the "Enter" key to toggle the "Automatic Scan" function on.

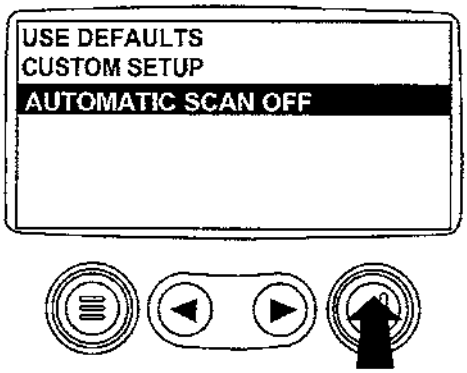


RG13222 —UN—26SEP03

Automatic Scan On

OURGP11,00000B1 -19-03SEP03-15/18

17. Press the "Enter" key again to toggle the "Automatic Scan" function off.



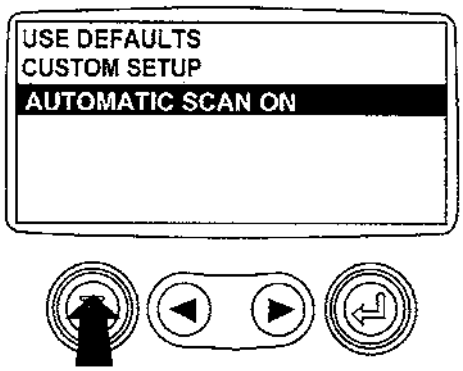
RG13223 —UN—26SEP03

Automatic Scan Off

Continued on next page

OURGP11,00000B1 -19-03SEP03-16/18

18. Once the "Use Defaults", "Custom Setup" and "Automatic Scan" functions have been set, press the "Menu" key to return to the main menu.

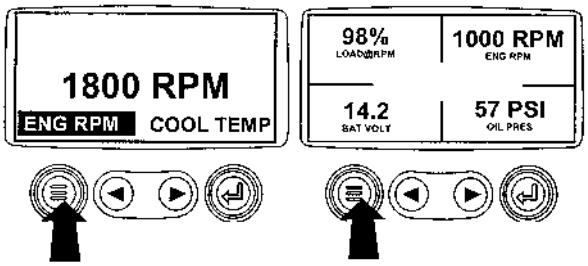


RG13224 —UN—26SEP03

Menu Key

OURGP11,00000B1 -19-03SEP03-17/18

19. Press the "Menu" key to exit the main menu and return to the engine parameter display.



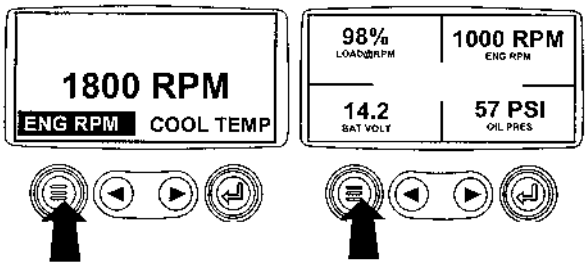
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,00000B1 -19-03SEP03-18/18

Setup 4-Up Display

1. Turn the key switch to the ON position. From the single or four engine parameter display, press the "Menu" key.

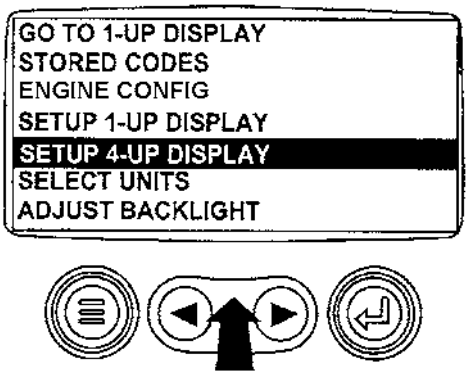


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000B2 -19-03SEP03-1/14

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Setup 4-Up Display" is highlighted.



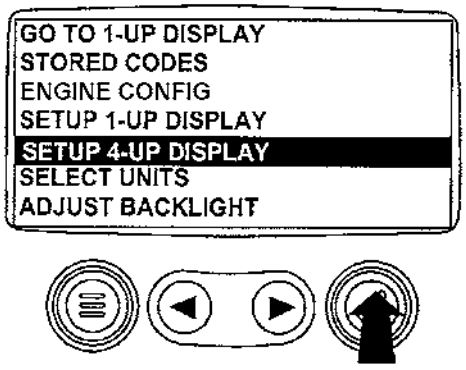
RG13225 —UN—02OCT03

Select Setup 4-Up Display

Continued on next page

OURGP11,00000B2 -19-03SEP03-2/14

3. Once the "Setup 4-Up Display" menu item has been highlighted, press the "Enter" key to activate the "Setup 4-Up Display" menu.

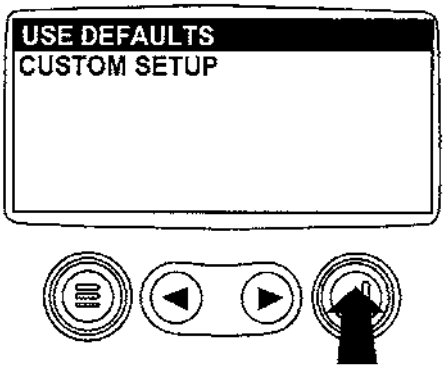


RG13226 —UN—02OCT03

Press Enter Key

OURGP11,00000B2 -19-03SEP03-3/14

4. Two options are available for the 4-Up Display.
   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Speed, Battery Voltage, Coolant Temperature and Oil Pressure.
   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters.

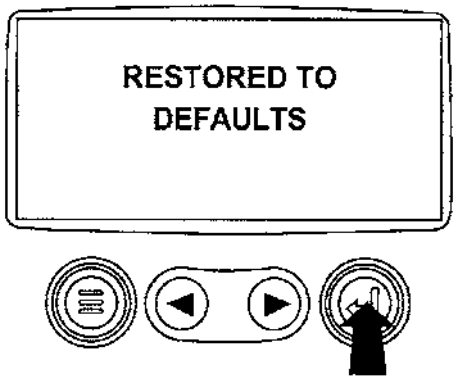


RG13244 —UN—02OCT03

Select Factory Defaults

OURGP11,00000B2 -19-03SEP03-4/14

5. To reset the display parameters to the factory defaults, scroll to and highlight "Use Defaults". Press the "Enter" key to activate the "Use Defaults" function. A message indicating the display parameters are reset to the factory defaults will be displayed, then the display will return to the "Setup 4-Up Display" menu.



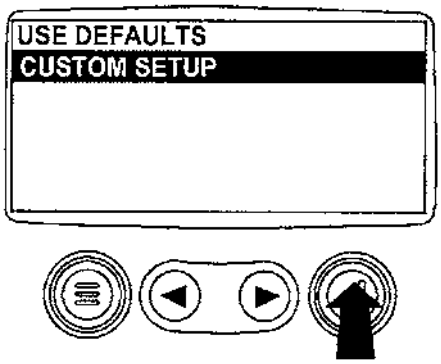
RG13149 —UN—24SEP03

Restored To Defaults

Continued on next page

OURGP11,00000B2 -19-03SEP03-5/14

6. **Custom Setup** - To perform a custom setup of the 4-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

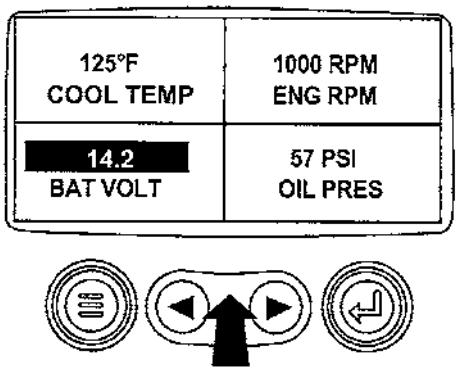


RG13227 —UN—26SEP03

Custom Setup

OURGP11,00000B2 -19-03SEP03-6/14

7. The quadrant with the highlighted parameter value is the current selected parameter. Use the "Arrow" keys to highlight the value in the quadrant you wish to change to a new parameter.

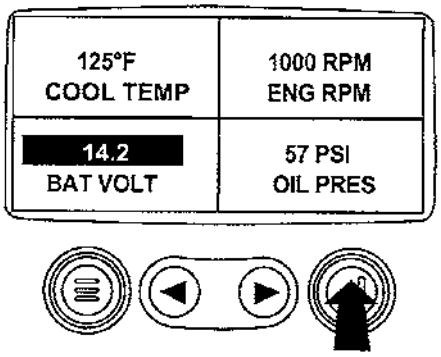


RG13228 —UN—26SEP03

Select Parameters

OURGP11,00000B2 -19-03SEP03-7/14

8. Press the "Enter" key and a list of engine parameters will be displayed.



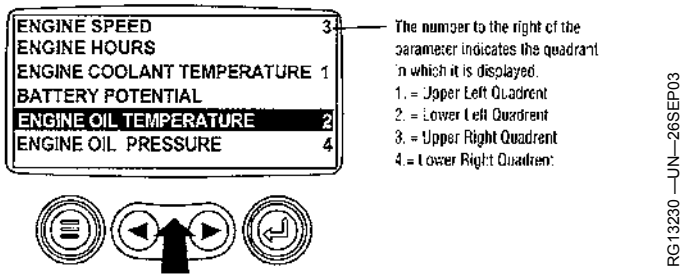
RG13229 —UN—26SEP03

List Of Engine Parameters

Continued on next page

OURGP11,00000B2 -19-03SEP03-8/14

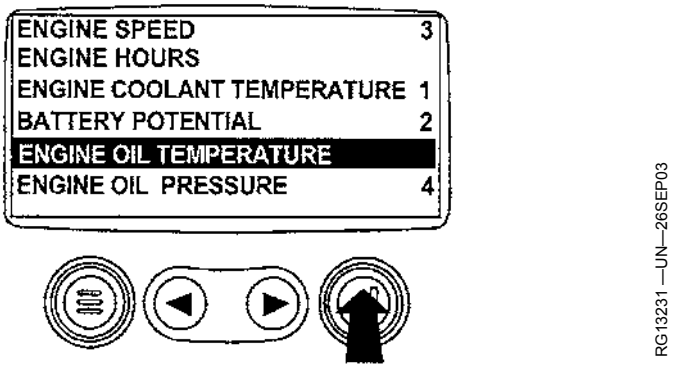
9. The parameter that is highlighted is the selected parameter for the screen. Use the "arrow" keys to highlight the new parameter to be placed in the "4-Up Display".


ENGINE SPEED 3
ENGINE HOURS
ENGINE COOLANT TEMPERATURE 1
BATTERY POTENTIAL
ENGINE OIL TEMPERATURE 2
ENGINE OIL PRESSURE 4
The number to the right of the parameter indicates the quadrant in which it is displayed.
1. = Upper Left Quadrant
2. = Lower Left Quadrant
3. = Upper Right Quadrant
4. = Lower Right Quadrant
RG13230 —UN—26SEP03

Select Desired Engine Parameter

OURGP11,00000B2 -19-03SEP03-9/14

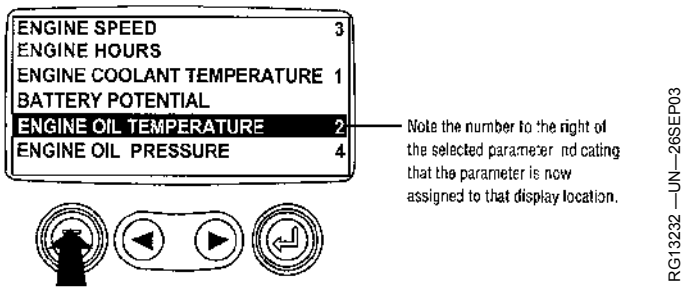
10. Press the "Enter" key to change the selected parameter in the quadrant to the new parameter.



Enter Selected Parameter

OURGP11,00000B2 -19-03SEP03-10/14

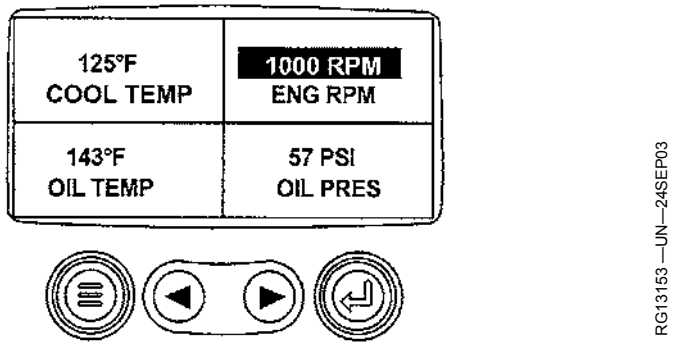
11. Use the "Menu" keys to return to the "4-Up Custom Setup" screen.


ENGINE SPEED 3
ENGINE HOURS
ENGINE COOLANT TEMPERATURE 1
BATTERY POTENTIAL
ENGINE OIL TEMPERATURE 2
ENGINE OIL PRESSURE 4
Note the number to the right of the selected parameter indicating that the parameter is now assigned to that display location.
RG13232 —UN—26SEP03

Return To 4-Up Custom Setup

OURGP11,00000B2 -19-03SEP03-11/14

12. The selected quadrant has now changed to the new selected parameter.

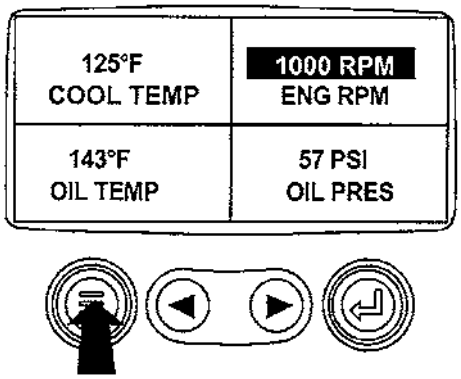


4-Up Display

Continued on next page

OURGP11,00000B2 -19-03SEP03-12/14

13. Repeat the parameter selection process until all spaces are as desired.
14. Press the "Menu" key to return to the main menu.

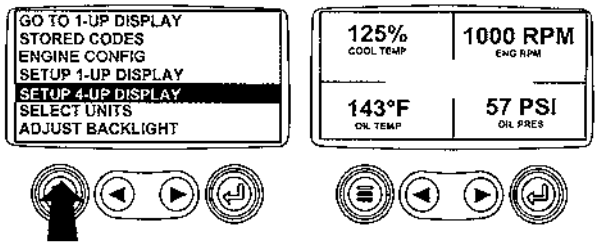


RG13154 —UN—24SEP03

Return To Main Menu

OURGP11,00000B2 -19-03SEP03-13/14

15. Press the "Menu" key to exit the main menu and return to the engine parameter display.



RG13155 —UN—07OCT03

Select Remaining Parameters

OURGP11,00000B2 -19-03SEP03-14/14

Break-in period

Within first 100 hours of operation:
During the first 100 hours of operation, avoid overloading, excessive idling and no-load operation.

If oil has to be added during this time, see ENGINE BREAK-IN OIL.

NOTE: During the break-in period a higher-than-usual oil consumption should be considered as normal.

After first 100 hours of operation:

After the first 100 hours, drain the crankcase and change the oil filter (see CHANGING ENGINE OIL AND FILTER). Fill crankcase with seasonal viscosity grade oil (see DIESEL ENGINE OIL).

Check tension of alternator belt.

Check connections of air intake hoses.

Check for proper tightening of cap screws all around the engine.

DPSG,CD03523,17 -19-22JAN07-1/1

Starting the engine

CAUTION: Before starting engine in a confined building, install proper outlet exhaust ventilation equipment. Always use safety approved fuel storage and piping.

NOTE: If temperature is below 0 ° C (32 ° F), it may be necessary to use cold weather starting aids (See COLD WEATHER OPERATION).

1. Perform all prestarting checks outlined in Maintenance/Daily Section.
2. Open the fuel supply shut-off valve, if equipped.
3. Activate the starter motor switch to crank the engine and release it as soon as engine starts.

NOTE: Do not operate the starter motor more than 20 seconds at a time.

DPSG,CD03523,18 -19-22JAN07-1/1

Cold weather operation

Depending on equipment, various cold weather starting aids are available to assist in starting the engine at temperature below 0° C (32 °F).

Air intake heater

⚠ CAUTION: DO NOT use starting fluid on engines equipped with grid-type air intake heater or glow plug (s). Ether starting fluid is highly flammable and may explode, causing serious injury.

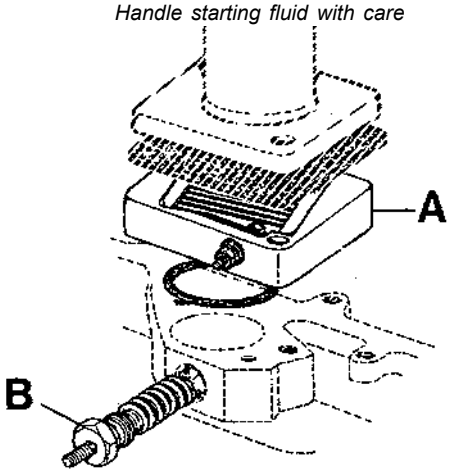
NOTE: On engines with electronically controlled fuel system (DE10, HPCR), the air intake heater operates automatically, controlled by the ECU. An engine preheater indicator light comes on when the key switch is turned ON. In warm weather, the light comes on briefly for a light check. In cold weather, the light remains ON during the automatic operation of the air intake heater or glow plug (s). Operating time depends on temperature. Do not crank engine until light goes OFF.

- **3029 and 4039 engines** are optionally equipped with the single glow plug (B) screwed in cylinder head intake manifold. Activate the glow plug (preheater position) for 30 seconds maximum then start the engine.
- **4045 and 6068 engines** (except HPCR, 4-valve head) are optionally equipped with the grid-type air heater (A) installed between cylinder head and air intake pipe.
  - For mechanical fuel system, activate the heating element (preheater position) for 30 seconds maximum then start the engine.
  - For electronically controlled engines (DE10, HPCR 2-valve head), turn key switch ON, but DO NOT crank engine until engine preheater indicator light turns OFF.
- **HPCR, 4-valve head engines** are equipped with glow plugs (one per cylinder) (C). Turn key switch ON, but DO NOT crank engine until preheater indicator light turns OFF.

A—Grid-Type heater (4045 and 6068 non HPCR 4-valve head engines)
B—Single Glow Plug (3029 and 4039 engines)
C—Multiple Glow Plugs (HPCR 4-valve head engines)

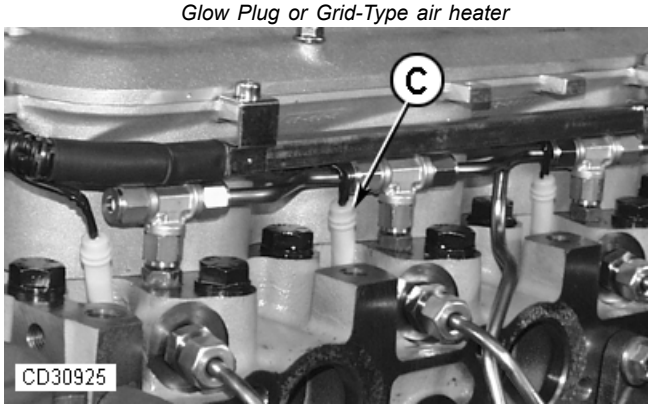
TS1356 —UN—18MAR92

Handle starting fluid with care



CD30750 —UN—03SEP99

Glow Plug or Grid-Type air heater



CD30925 —UN—23JAN07

Glow Plugs on HPCR, 4-valve head engine

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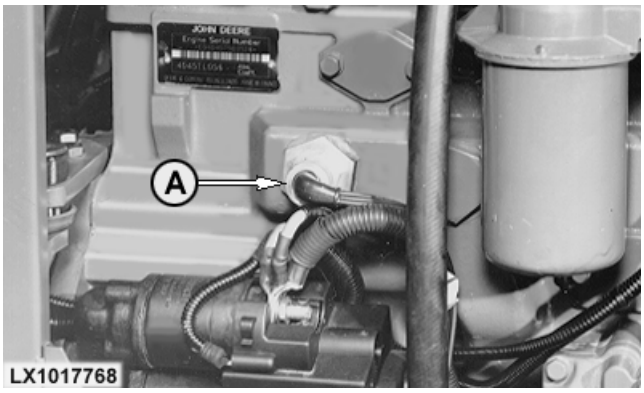
DPSG,CD03523,19 -19-06FEB07-1/3

Coolant heater

Connect plug of coolant heater (A) to a proper power source (110 or 220 V).

At an ambient temperature of -15°C (5°F), the heating process takes approximatively 2 hours. Extend heating period if ambient temperature is lower.

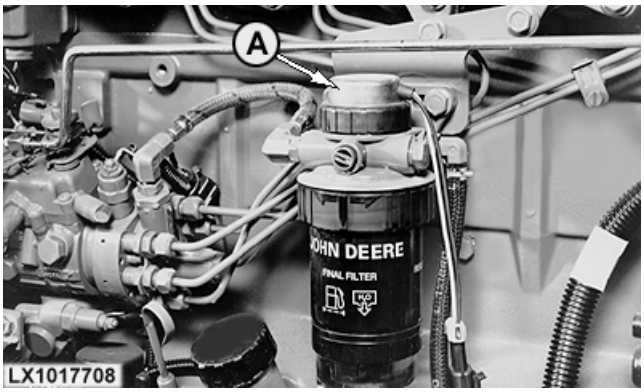


LX1017768 —UN—24OCT97

DPSG,CD03523,19 -19-06FEB07-2/3

Fuel preheater

Fuel preheater (A) switches ON and OFF automatically in relation with the ambient temperature.



LX1017708 —UN—09OCT97

DPSG,CD03523,19 -19-06FEB07-3/3

Using a booster battery or charger

A 12-volt booster battery can be connected in parallel with battery(ies) on the unit to aid in cold weather starting. ALWAYS use heavy duty jumper cables.

CAUTION: Gas given off by battery is explosive. Keep sparks and flames away from battery. Before connecting or disconnecting a battery charger, turn charger off. Make last connection and first disconnection at a point away from battery. Always connect NEGATIVE (–) cable last and disconnect this cable first.

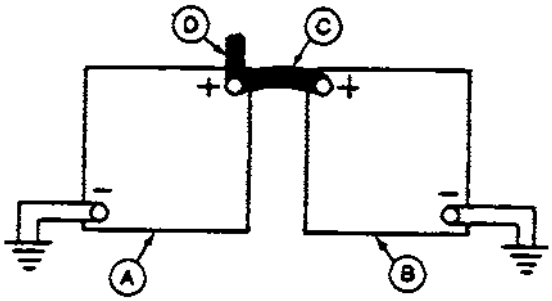
IMPORTANT: Be sure polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12-volt booster battery for 12-volt electrical systems and 24-volt booster battery(ies) for 24-volt electrical systems.

1. Connect booster battery or batteries to produce the required system voltage for your engine application.

NOTE: To avoid sparks, DO NOT allow the free ends of jumper cables to touch the engine.

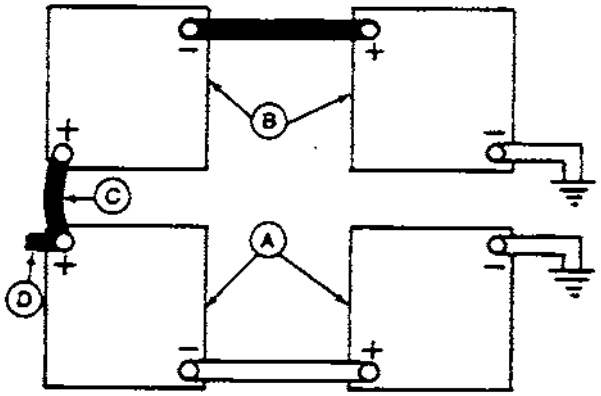
2. Connect one end of jumper cable to the POSITIVE (+) post of the booster battery.
3. Connect the other end of the jumper cable to the POSITIVE (+) post of battery connected to starter.
4. Connect one end of the other jumper cable to the NEGATIVE (–) post of the booster battery.
5. ALWAYS complete the hookup by making the last connection of the NEGATIVE (–) cable to a good ground on the engine frame and away from the battery(ies).
6. Start the engine. Disconnect jumper cables immediately after engine starts. Disconnect NEGATIVE (–) cable first.

TS204 —UN—23AUG88



RG4678 —UN—14DEC88

12-Volt System



RG4698 —UN—14DEC88

24-Volts System

A—12-Volt Machine battery (ies)
B—12-Volt Booster battery (ies)
C—Booster cable
D—Cable to starter motor

DPSG,CD03523,20 -19-22JAN07-1/1

Engine operation

Warming engine
Operate engine at high idle for 1 to 2 minutes before applying the load.

NOTE: This procedure does not apply to standby generator sets where the engine is loaded immediately upon reaching rated speed.

Normal engine operation
Compare engine coolant temperature and engine oil pressure with specifications below:

	Specification
Minimum oil pressure at full load rated speed[1] —Pressure	275 kPa (2.75 bar) (40 psi)
Coolant temperature range—Temperature	82°—94°C (180°—202°F)

Stop engine immediately if coolant temperature is above or oil pressure below specifications or if there are any signs of part failure. Symptoms that may be early signs of engine problems could be:

- Sudden loss of power
- Unusual noise or vibration
- Excessive black exhaust
- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

[1]*Oil at normal operating temperature of 115°C (240°F).*

Recommendation for turbocharger engines
Should the engine stall when operating under load, IMMEDIATELY restart it to prevent overheating of turbocharger components.

Idling engine
Avoid excessive engine idling. Prolonged idling may cause the engine coolant temperature to fall below its normal range. This, in turn, causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge and unburned fuel in the exhaust system. If an engine will be idling for more than 5 minutes, stop and restart later.

NOTE: Generator set applications have the governor locked at a specified speed and do not have a slow idle function. These engines idle at no load governed speed (fast idle).

DPSG,CD03523,21 -19-22JAN07-1/1

Standby power units

To assure that your engine will deliver efficient standby operation when needed, start engine and run at rated speed (with 50%—70% load) for 30 minutes every 2 weeks. DO NOT allow engine to run extended period of time with no load.

DPSG,CD03523,22 -19-22JAN07-1/1

Stopping the engine

1. Before stopping, run engine for at least 2 minutes at fast idle and no load.
2. Stop the engine.

DPSG,CD03523,23 -19-22JAN07-1/1

Changing Generator Frequency

Generator sets powered by 6068HFU74 engine are dual-frequency; 50 Hz (1500 rpm) or 60 Hz (1800 rpm). Refer to the generator set documentation for more information.

CD03523,000018C -19-26JAN07-1/1

Maintenance

Observe service intervals

Using hour meter as a guide, perform all services at the hourly intervals indicated on following pages. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed using charts provided in Maintenance Records Section.

IMPORTANT: Recommended service intervals are for normal operating conditions. Service MORE OFTEN if engine is operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.

DPSG,CD03523,24 -19-22JAN07-1/1

Use correct fuels, lubricants and coolant

IMPORTANT: Use only fuels, lubricants, and coolants meeting specifications outlined in Fuels, Lubricants, and Coolant Section when servicing your John Deere Engine.

Consult your John Deere engine distributor, servicing dealer or your nearest John Deere Parts Network for recommended fuels, lubricants, and coolant. Also available are necessary additives for use when operating engines in tropical, arctic, or any other adverse conditions.

TS100 —UN—23AUG88

DPSG,CD03523,25 -19-22JAN07-1/1

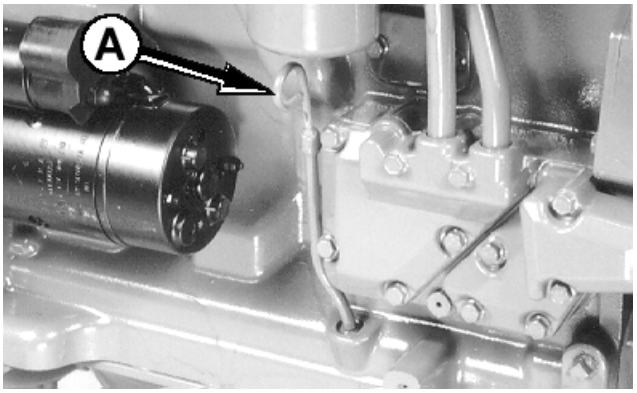
Maintenance interval chart

Item	10 H / daily	500 H	1000 H / 1 year	2000 H / 2 years	2500 H / 3 years	As required
Check engine oil and coolant level	•					
Check air filter restriction indicator[a]	•					
Change engine oil and filter[b]		•				
Replace fuel filter element(s)		•				
Check belt tension and automatic tensioner[c]		•	•			
Check and adjust valve clearance[d]			•	•		
Clean crankcase vent tube			•			
Check air intake hoses, connections and system			•			
Pressure test cooling system			•			
Check vibration damper (6 cyl.)[e]				•		
Check engine speed and speed drop governor				•		
Drain and flush cooling system[f]				•	•	
Drain water and sediment from fuel filter						•
Clean filter element (see note a)						•
Test thermostat and injection nozzles (see your dealer)[g]						•
Test glow plugs (HPCR, 4-valve head)				•		

[a]Clean air filter element when restriction indicator is red. Replace filter element after 6 cleanings or once a year.
[b]Change oil and filter after the first 100 hours of operation, then every 500 hours maximum thereafter (see DIESEL ENGINE OIL information). Change oil and filter at least once a year.
[c]Check belt tension every 500 hours on 3029 and 4039 engines and on 4045 and 6068 engines with manual tensioner. Check automatic belt tensioner every 1000 hours/1 year on 4045 and 6068 engines when equipped.
[d]Have your authorized servicing dealer or engine distributor adjust valve clearance as follows. After the first 500 hours of operation then every 1000 hours thereafter on 3029 and 4039 engines. Every 2000 hours on 4045 and 6068 engines.
[e]Have your authorized dealer or engine distributor replace the vibration damper every 4500 hours/5 years.
[f]Drain and flush cooling system every 2500 hours/3 years when John Deere COOL-GARD coolant is used. Otherwise every 2000 hours/2 years.
[g]Contact your dealer when thermostat or injection nozzles are suspected to be defective. Replace injection nozzles every 5000 hours and thermostat every 10000 hours.

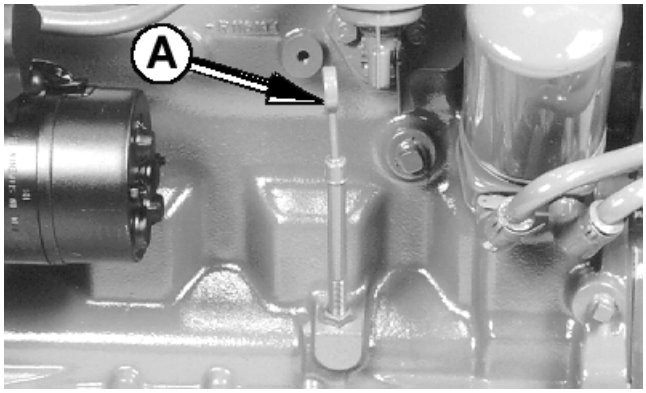
DPSG,CD03523,26 -19-25JAN07-1/1

Daily prestarting checks



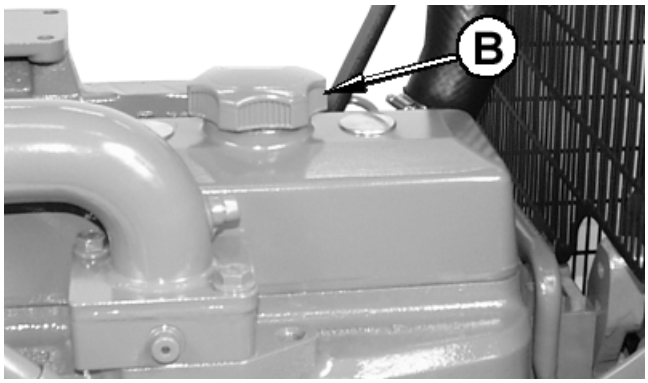
CD30753 —UN—26AUG99

4045 and 6068 engines

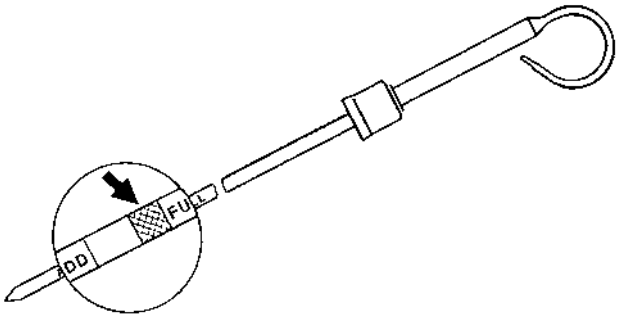


CD30754 —UN—26AUG99

3029 and 4039 engines



CD30755 —UN—24SEP99



FD000047

FD000047 —UN—13MAR96

Do the following BEFORE STARTING THE ENGINE for the first time each day:

IMPORTANT: DO NOT add makeup oil until the oil level is BELOW the add mark.

1. Check engine oil level on dipstick (A). Add as required, using seasonal viscosity grade oil. (See DIESEL ENGINE OIL). Add oil at rocker arm cover filler cap (B).

IMPORTANT: DO NOT fill above the crosshatch area. Oil levels anywhere within crosshatch are considered in the acceptable operating range.

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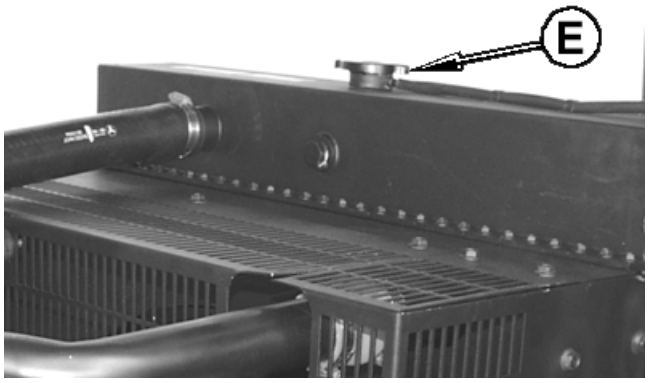
DPSG,CD03523,27 -19-07FEB07-1/4

TS281 —UN—23AUG88



CD30756 —UN—26AUG99

2.

⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Only remove filler cap when engine is cold or when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Remove radiator cap (E) and check coolant level which should be at bottom of filler neck. Fill radiator with proper coolant solution if level is low. (See DIESEL ENGINE COOLANT). Check entire cooling system for leaks.

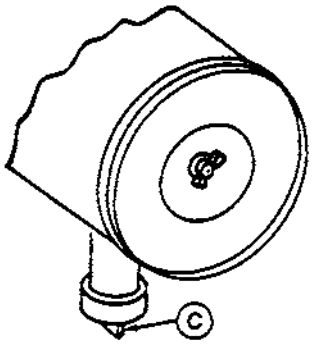
DPSG,CD03523,27 -19-07FEB07-2/4

3. If air filter has a dust unloader valve (C), squeeze valve tip to release any trapped dirt particles.
4. Check air intake restriction indicator (D). When indicator is red, air filter needs to be cleaned.

IMPORTANT: Maximum air intake restriction is 6.25 kPa (0.06 bar) (1.0 psi) (25 in. H2O). A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.

5. Make a thorough inspection of the engine compartment.

NOTE: Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.



RG4687 —UN—20DEC88

CD30757 —UN—26AUG99

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DPSG,CD03523,27 -19-07FEB07-3/4

6.

NOTE: Engines with mechanical fuel system have a single fuel filter while electronically controlled engines (DE10 and HPCR fuel systems) have two fuel filters (primary and final). Moreover these electronically controlled engines may be equipped with a water sensor at the fuel filters. An indicator light on the instrument panel will signal the operator that water should be drained from filter bowls.

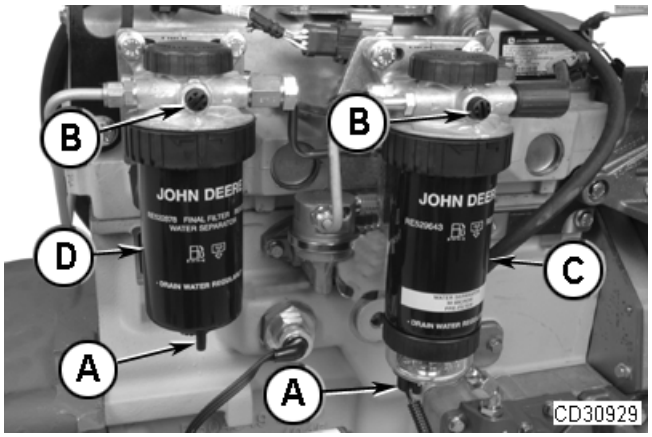
Check fuel filters (C) and (D) for water and debris as follows:

a. Loosen drain plug(s) (A) at bottom of fuel filter(s) or bowl(s) two or three turns.

b. Loosen air bleed plug(s) (B) two full turns and drain water into a suitable container.

c. When fuel starts to drain out, tighten drain plug(s) securely.

d. Bleed fuel system.



CD30929 —UN—07FEB07

Drain fuel filter(s)

A—Drain plug
B—Air bleed plug
C—Primary fuel filter
D—Final fuel filter

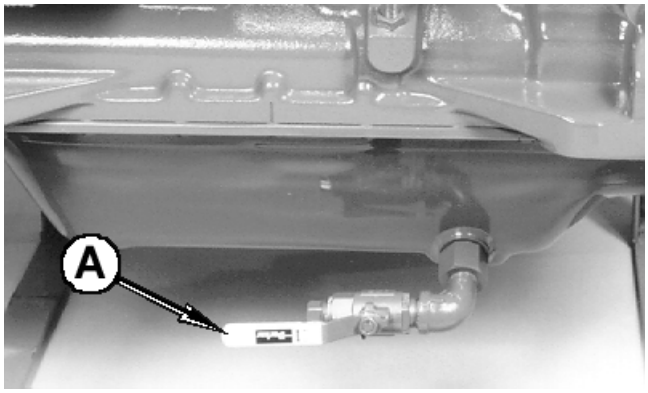
DPSG,CD03523,27 -19-07FEB07-4/4

Changing engine oil and filter

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

NOTE: Change engine oil and filter for the first time after 100 hours maximum of operation, then every 500 hours thereafter. Change oil and filter at leat once a year.

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Open oil pan drain valve (A).
3. Drain crankcase oil from engine while warm.



CD30758 —UN—26AUG99

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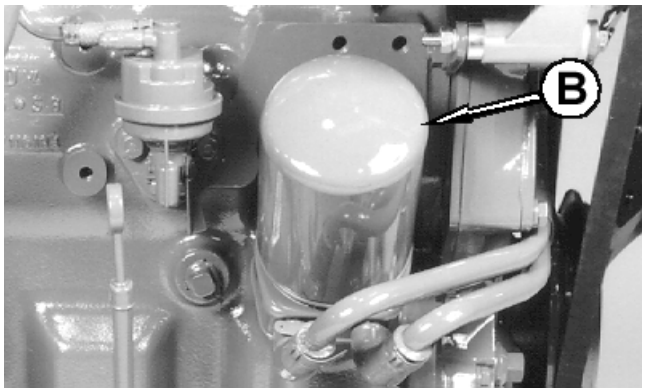
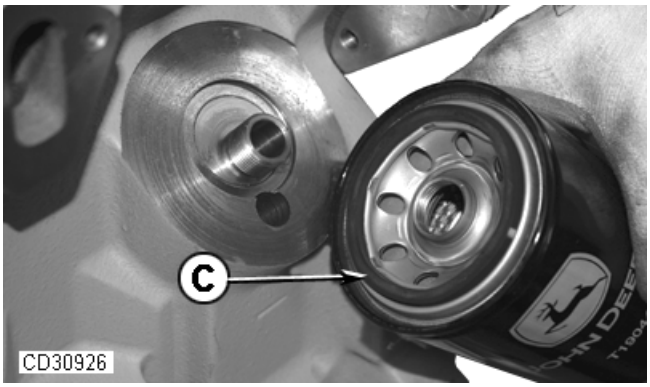
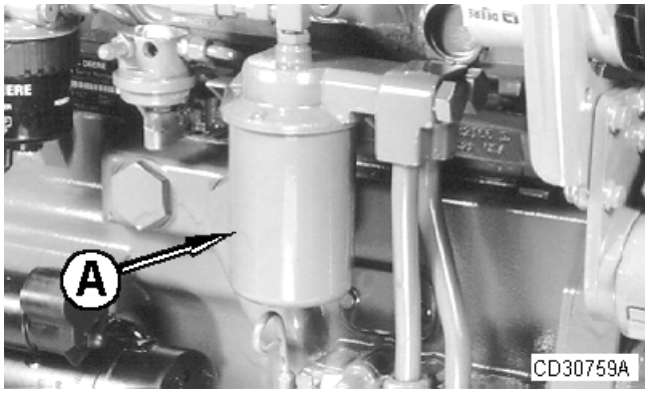
DPSG,CD03523,29 -19-01JUL09-1/3



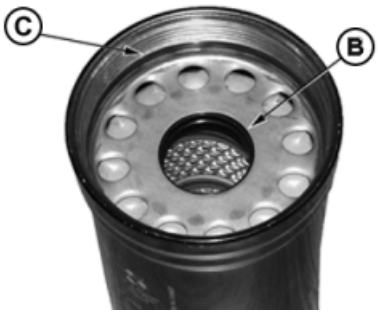
Oil filter on 3029 and 4039 engines



Oil new filter element packing



Oil filter on 4045 and 6068 engines

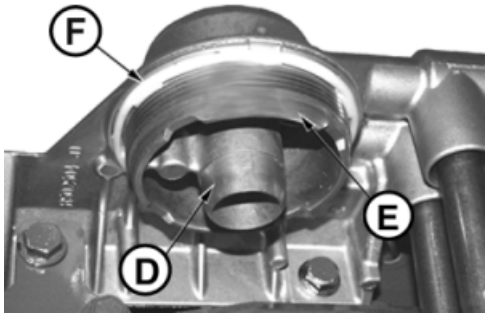


Oil filter seals

4. Replace oil filter

   • 3029 and 4039 engines
   a. Remove and discard oil filter element (B) using a suitable filter wrench.
   b. Oil new packing (C) and install new filter element. Hand tighten element according to values printed on filter element. If values are not provided, tighten element approximately 3/4 — 1-1/4 turn after packing contacts filter housing. DO NOT overtighten filter element.

   • 4045 and 6068 engines
   a. Remove and discard oil filter element (A) using a suitable filter wrench.
   b. Apply clean engine oil to inner (B) and outer (C) seals and to filter threads.
   c. Wipe both sealing surfaces of the header (D, E) with a clean rag. Ensure notches in dust seal (F) are properly installed in the slots in the housing. Replace dust seal if damaged.
   d. Install and tighten oil filter by hand until firmly against dust seal (F). DO NOT overtighten.



Filter and mounting header

A—Oil filter element
B—Inner seal
C—Outer seal
D—Sealing surface
E—Sealing surface
F—Dust seal

5. Close oil pan drain valve.

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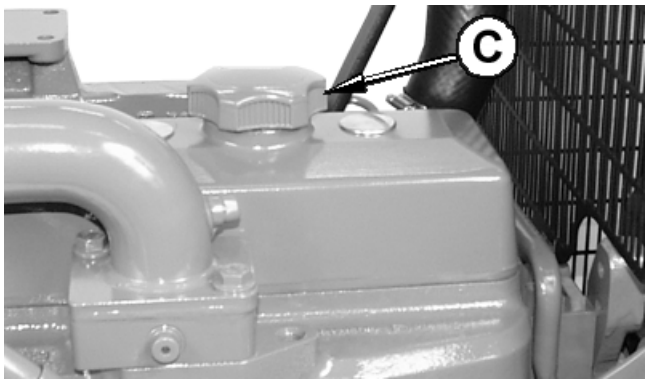
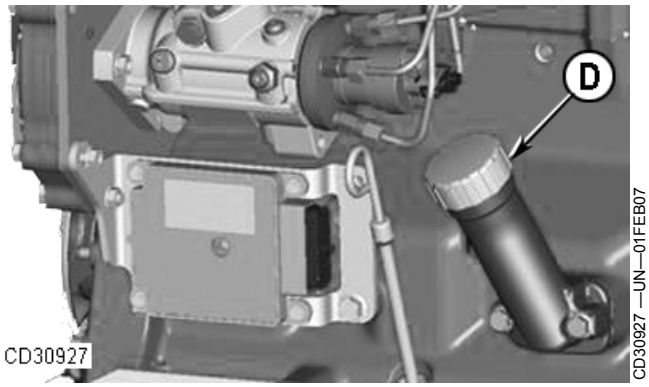
DPSG,CD03523,29 -19-01JUL09-2/3



Oil filler cap on rocker arm cover



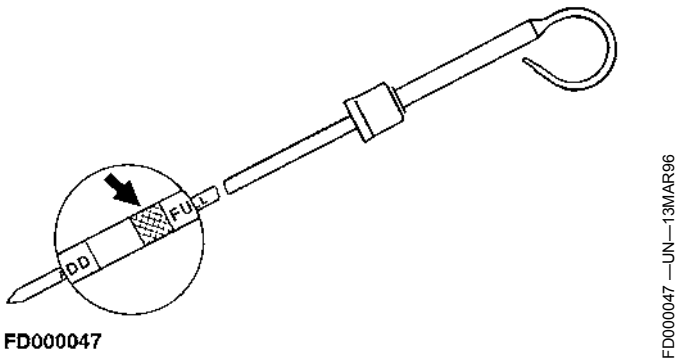
Oil filler neck on engine side

6. Fill engine crankcase with correct John Deere engine oil through opening on rocker arm cover (C) or on the side of the engine (D). See DIESEL ENGINE OIL Section for determining correct engine oil.

   To determine the correct oil fill quantity for your engine, see the Specifications Section.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch on dipstick, whichever is present. DO NOT overfill.

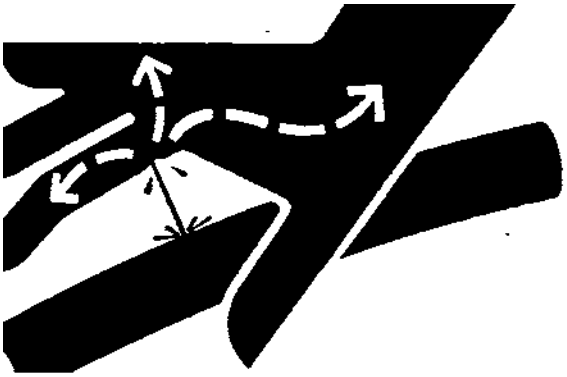
7. Start engine and run to check for possible leaks.
8. Stop engine and check oil level after 10 minutes. If necessary, top up.



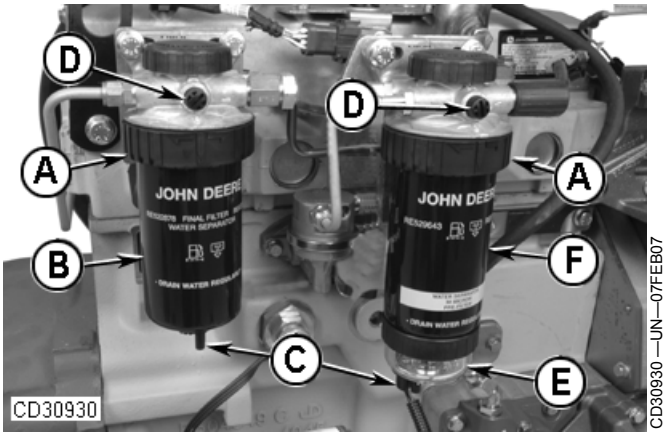
Oil dipstick

DPSG,CD03523,29 -19-01JUL09-3/3

Replacing fuel filter element(s)



X9811 —UN—23AUG88



CD30930 —UN—07FEB07

Fuel filters

A—Retaining ring
B—Final fuel filter element
C—Drain plug
D—Bleed plug
E—Water separator bowl
F—Primary fuel filter element

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

NOTE: Engines with mechanical fuel system have a single fuel filter while electronically controlled engines (DE10, HPCR) have two fuel filters (primary and final). Both the primary and the final filters have to be replaced together at the same time.

1. Thoroughly clean fuel filter assembly and surrounding area.
2. Loosen drain plug (C) and drain fuel into a suitable container.

NOTE: Lifting up on retaining ring as it is rotated helps to get it past raised locators.

3. Firmly grasp the retaining ring (A) and rotate it clockwise 1/4 turn. Remove ring with filter element (B).

IMPORTANT: Do not dump the old fuel into the new filter element. This could cause fuel injection problem.

A plug is provided with the new element for plugging the used element.

4. Inspect filter mounting base for cleanliness. Clean as required.

NOTE: Raised locators on fuel filter canister must be indexed properly with slots in mounting base for correct installation.

5. Install new filter element dry onto mounting base. Be sure element is properly indexed and firmly seated on base. It may be necessary to rotate filter for correct alignment.
6. Install retaining ring onto mounting base making certain dust seal is in place on filter base. Hand tighten ring (about 1/3 turn) until it ”snaps” into the detent. DO NOT overtighten retaining ring.

NOTE: The proper installation is indicated when a "click" is heard and a release of the retaining ring is felt.

7. Bleed the fuel system.

DPSG,CD03523,30 -19-07FEB07-1/1

Checking belt (3029 and 4039 Engines)

1. Inspect belt for cracks, fraying, or stretched out areas. Replace as necessary.
2. Check belt tension using one of following methods:

   a) Use of JDG529 Tension Gauge (A)

Specification	
Belt tension—New belt	578—622 N (130—140 lb-force)
Used belt	378—423 N (85—94 lb-force)

NOTE: Belt is considered used after 10 minutes of operation.

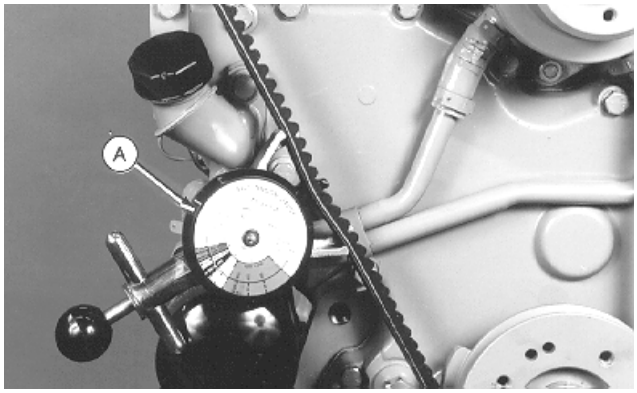
   b) Use of tension tester (B) and straightedge (C)
   A 89 N (20 lb) force applied halfway between pulleys should deflect belt by 19 mm (0.75 in.).

3. If adjustment is necessary, loosen alternator nuts (D) and (E). Pull alternator frame outward until belt is correctly tensioned.

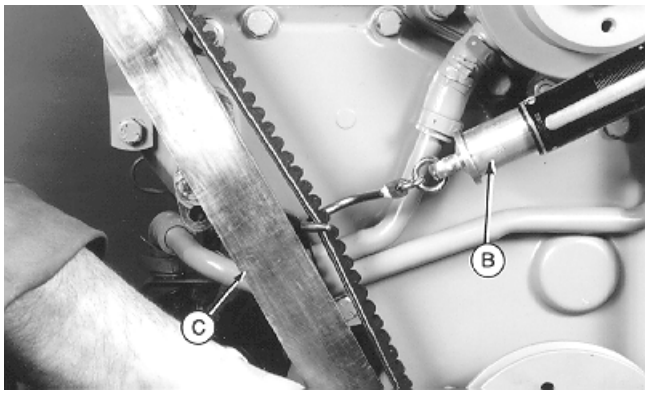
IMPORTANT: Do not pry against the alternator rear frame. Do not tighten or loosen belts while they are hot.

4. Tighten alternator bracket nuts firmly.
5. Run engine for 10 minutes then recheck belt tension.

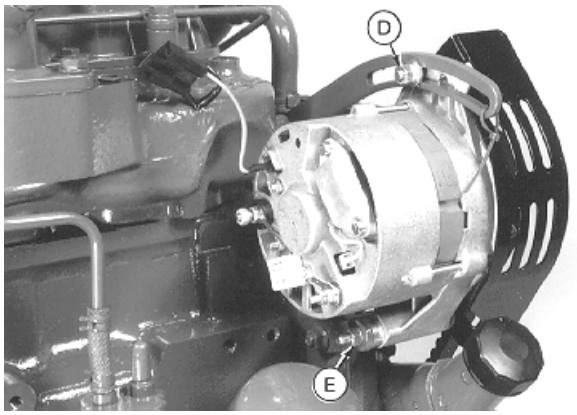
A—JDG529 Tension Gauge
B—Tension tester
C—Straightedge
D—Upper nut
E—Lower nut



CD30644 —UN—04MAY98



CD30645 —UN—04MAY98



CD30646 —UN—04MAY98

DPSG,CD03523,31 -19-30JAN07-1/1

Checking belt (4045 and 6068 Engines with manual tensioner)

Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.

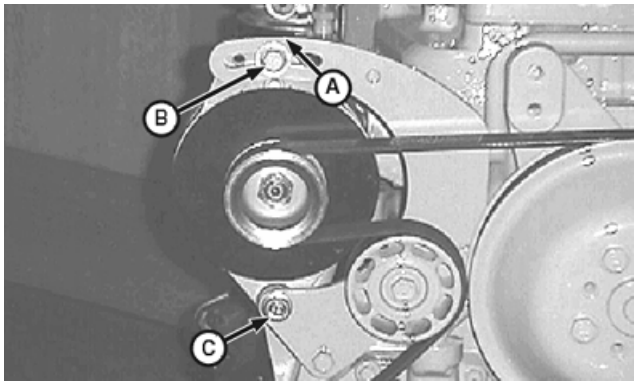
NOTE: Belt adjustment is measured using a gauge stamped on the top edge of the alternator bracket.

1. Loosen cap screws (B) and (C).
2. Slide alternator in slot by hand to remove all excess slack in belt. Scribe a reference mark (D) on line with notch (E) on upper alternator bracket.

IMPORTANT: Do not pry against alternator rear frame.

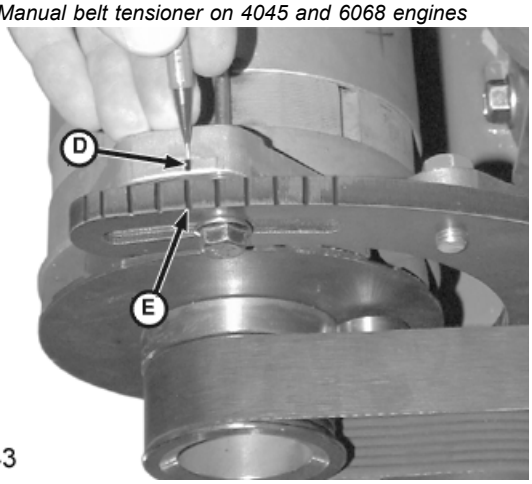
3. Using the gauge (A) on the alternator bracket, stretch belt by prying outward on alternator front frame. Stretch the belt 1 gauge unit for a used belt and 1.5 gauge units for a new belt.
4. Tighten cap screws (B) and (C).

A—Belt gauge
B—Cap screw
C—Cap screw
D—Reference mark
E—Alternator upper bracket notch



RG9132 —UN—04OCT99

Manual belt tensioner on 4045 and 6068 engines



CD30843

CD30843 —UN—10JAN03

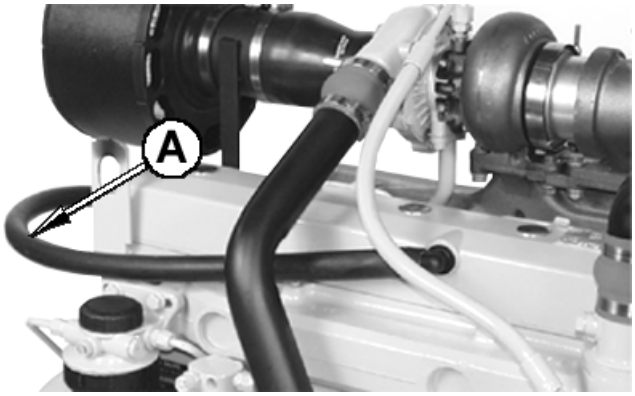
Reference marks

DPSG,CD03523,57 -19-30JAN07-1/1

Cleaning crankcase vent tube

If you operate the engine in dusty conditions, clean the tube at shorter intervals.

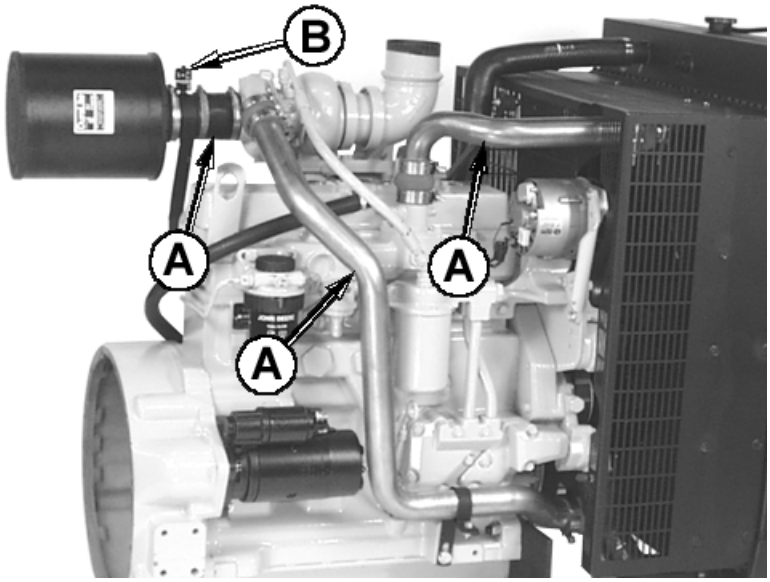
1. Remove and clean crankcase vent tube (A).
2. Install the vent tube. Be sure the O-ring fits correctly in the rocker arm cover for elbow adapter. Tighten hose clamp securely.



CD30773 —UN—27AUG99

DPSG,CD03523,32 -19-22JAN07-1/1

Checking air intake system



CD30762 —UN—27AUG99

IMPORTANT: The air intake system must not leak. Any leak, no matter how small, may result in engine failure due to abrasive dirt and dust entering the intake system.

1. Inspect all intake hoses (piping) for cracks. Replace as necessary.
2. Check clamps on piping (A) which connect the air filter, engine and, if present, turbocharger and air-to-air radiator. Tighten clamps as necessary.
3. Test air restriction indicator (B) for proper operation. Replace indicator as necessary.

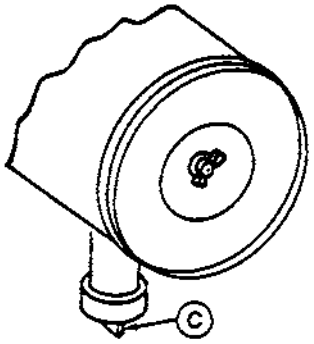
Continued on next page

DPSG,CD03523,33 -19-22JAN07-1/2

4.

If engine has a rubber dust unloader valve (C), inspect the valve on bottom of air filter for cracks or plugging. Replace as necessary.

5. Service air filter as necessary.



RG4687 —UN—20DEC88

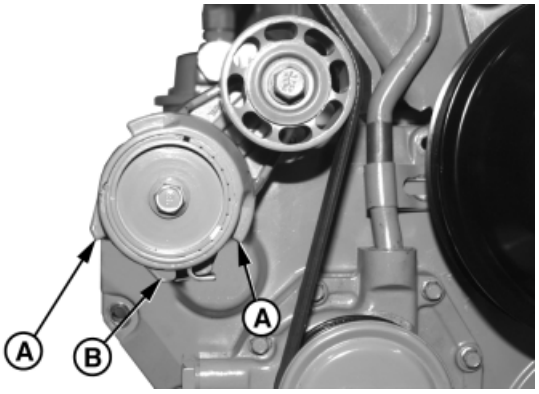
DPSG,CD03523,33 -19-22JAN07-2/2

Checking automatic belt tensioner (4045 and 6068 Engines)

Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

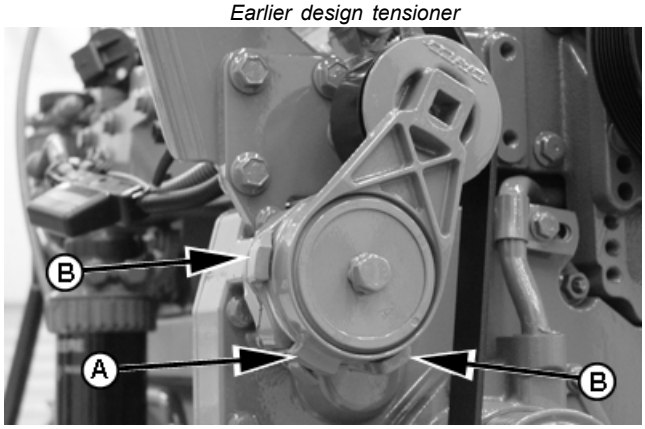
- **Checking belt wear**
  The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry is used. If the tensioner stop on swing arm (A) is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed (see REPLACING FAN AND ALTERNATOR BELTS).

A—Swing arm stop **B—Fixed cast stop**



RG8098 —UN—18NOV97

Earlier design tensioner



RG13744 —UN—11NOV04

Later design tensioner

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DPSG,CD03523,34 -19-30JAN07-1/2

- **Checking tensioner spring tension**
  A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

a. Release tension on belt using a breaker bar and socket on tension arm. Remove belt from pulleys.
b. Release tension on tension arm and remove breaker bar.
c. Put a mark (A) on swing arm of tensioner as shown.
d. Measure 21 mm (0.83 in.) from (A) and put a mark (B) on tensioner mounting base.

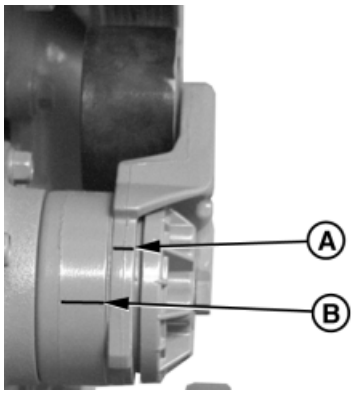
NOTE: Earlier engines have a LEFT-HAND thread roller cap screw while later engines have a 12.7 mm (1/2 in.) square hole in tensioner.

e. Install torque wrench on roller cap screw or in square hole so that it is aligned with center of roller and tensioner as shown. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
f. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

Specification

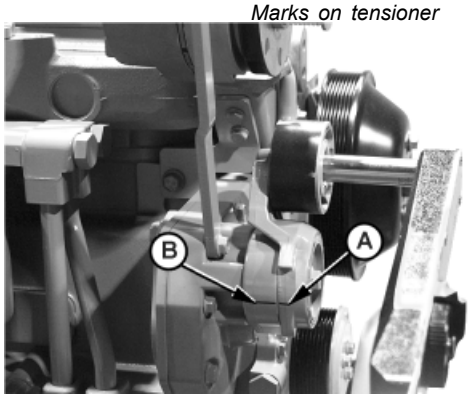
Spring—Force..... 18—22 N·m (13—16 lb-ft)

A—Mark on swing arm **B—Mark on tensioner mounting base**



RG7977 —UN—14NOV97

Marks on tensioner



RG12054 —UN—08JAN02

Align marks

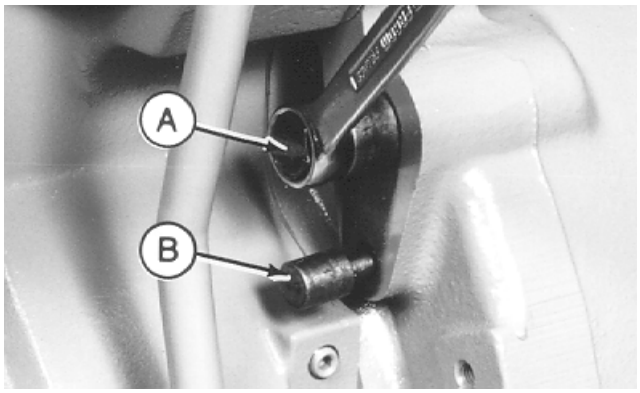
DPSG,CD03523,34 -19-30JAN07-2/2

Check and adjust engine valve clearance (3029 and 4039 Engines)

NOTE: Valve clearance must be adjusted after the first 500 hours of operation, then every 1000 hours thereafter.

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No.1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDE81-4 or JDG1571 (B) into flywheel bore.



CD30544 —UN—19MAY98

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DPSG,CD03523,35 -19-31JAN07-1/2

3. Check and adjust valve clearance to specifications according to following procedures.

Specification	
Valve clearance (engine cold)—Intake	0.35 mm (0.014 in.)
Exhaust	0.45 mm (0.018 in.)

NOTE: If rocker arm is equipped with adjusting screw and jam nut (A), tighten jam nut to 27 N·m (20 lb-ft) after adjusting valve clearance.

4. Reinstall rocker arm cover and crankcase vent tube.

- **3-Cylinder Engine:**

  NOTE: Firing order is 1-2-3

  a. Lock No. 1 piston at TDC compression stroke (D).
  b. Adjust valve clearance on No. 1 and 2 exhaust valves and No.1 and 3 intake valves.
  c. Rotate flywheel 360°. Lock No. 1 piston at TDC exhaust stroke (E).
  d. Adjust valve clearance on No. 3 exhaust valve and No. 2 intake valve.

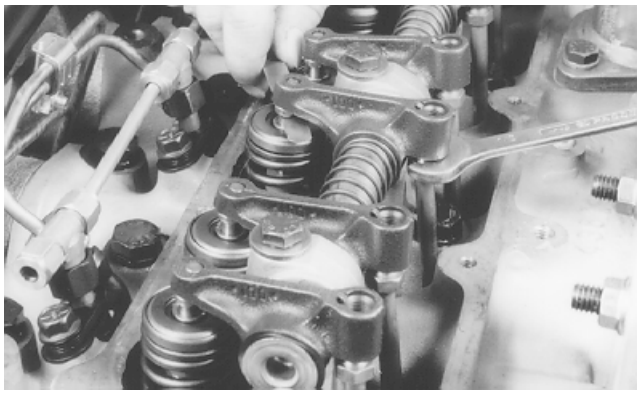
- **4-Cylinder Engine:**

  NOTE: Firing order is 1-3-4-2

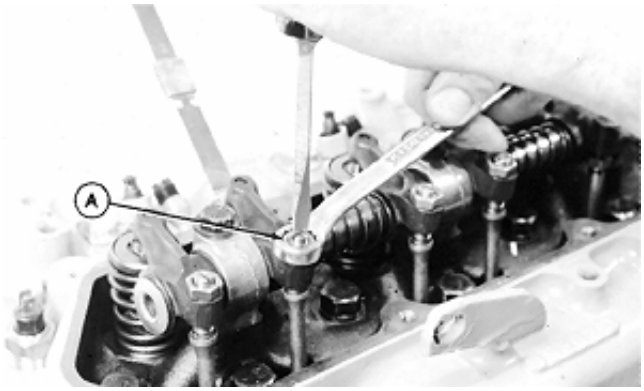
  a. Lock No. 1 piston at TDC compression stroke (B).
  b. Adjust valve clearance on No. 1 and 3 exhaust valves and No.1 and 2 intake valves.
  c. Rotate flywheel 360°. Lock No. 4 piston at TDC compression stroke (C).
  d. Adjust valve clearance on No. 2 and 4 exhaust valves and No. 3 and 4 intake valves.

A—Front of engine
B—Exhaust valve
C—Intake valve
D—No.1 Piston at TDC compression stroke
E—No.1 Piston at TDC exhaust stroke

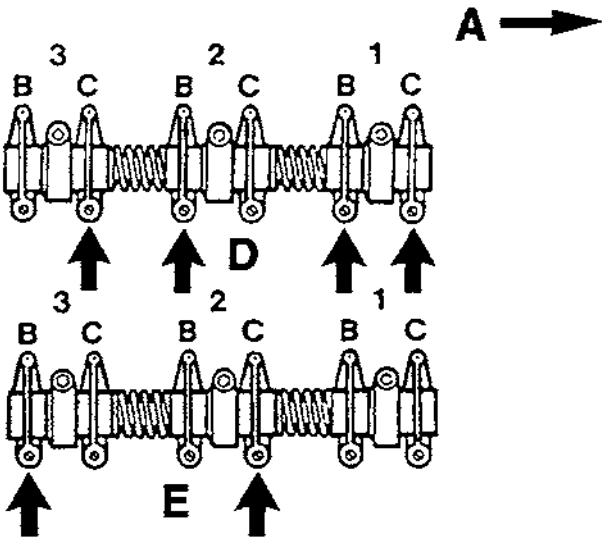
A—Front of engine
B—No.1 Piston at TDC compression stroke
C—No.4 Piston at TDC compression stroke
E—Exhaust valve
I— Intake valve



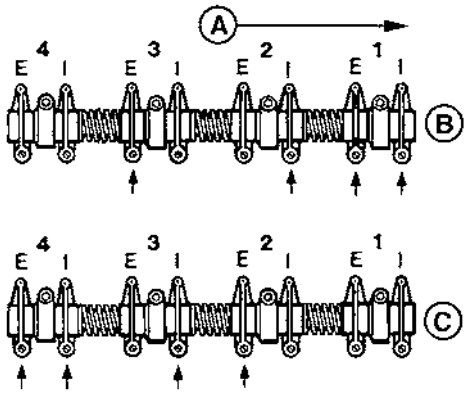
CD30545 —UN—19MAY98



RG6307 —UN—03AUG92



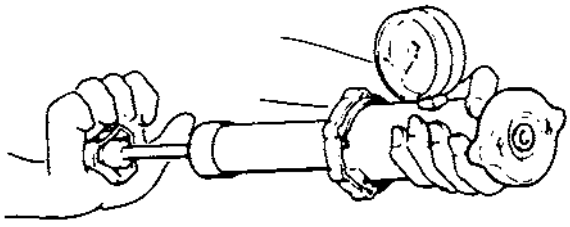
CD30549 —UN—16JUN98



RG4776 —UN—31OCT97

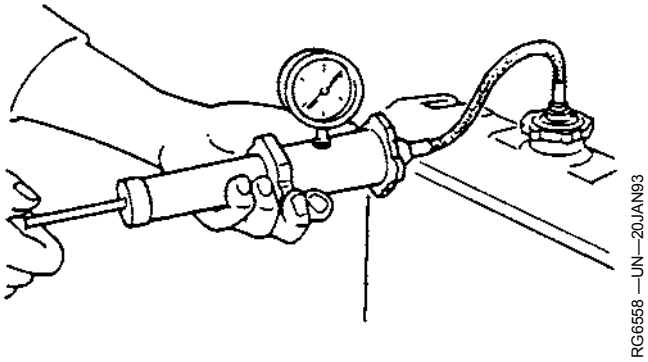
DPSG,CD03523,35 -19-31JAN07-2/2

Pressure testing cooling system



Test radiador cap

RG6557 —UN—20JAN93



RG6558 —UN—20JAN93

Test cooling system

⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engines. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Test Radiator Cap

1. Remove radiator cap and attach to D05104ST tester as shown.
2. Pressurize cap to specification listed. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

   If gauge does not hold pressure, replace radiator cap.

Specification

Radiator Cap
Calibration—Pressure..... 70 kPa (0.7 bar) (10 psi) for 10 seconds minimum

3. Remove the cap from gauge, turn it 180°, and retest cap to confirm measurement.

Test Cooling System

NOTE: Engine should be warmed up to test overall cooling system.

1. Allow engines to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

IMPORTANT: DO NOT apply excessive pressure to cooling system, doing so may damage radiator and hoses.

3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system to specification listed for radiator cap.
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

   If leakage is detected, correct as necessary and pressure test system again.

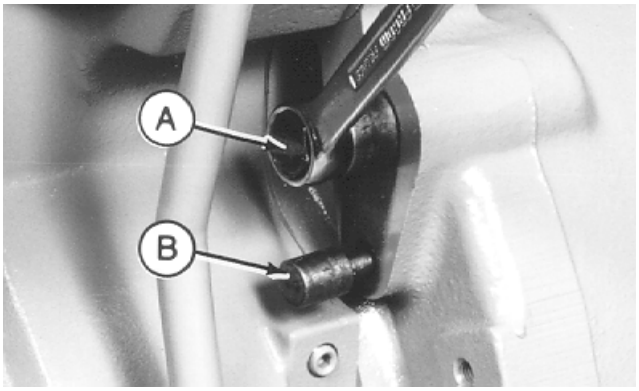
   If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to-head gasket. Have your engine distributor or servicing dealer correct this problem immediately.

CD03523,00000EC -19-22JAN07-1/1

Check and adjust engine valve clearance (4045 and 6068 Engines)

Adjust engine valve clearance as follows or have your authorized servicing dealer or engine distributor adjust the engine valve clearance.

1. Remove rocker arm cover and crankcase vent tube.
2. Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No.1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDE81-4 (B) into flywheel bore.



CD30544 —UN—19MAY98

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DPSG,CD03523,36 -19-31JAN07-1/2

3. Check and adjust valve clearance to specifications according to following procedures.

Specification	
Valve clearance (engine cold)—Intake	0.35 mm (0.014 in.)
Exhaust	0.45 mm (0.018 in.)

4. If valves need adjusting, loosen the locknut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten locknut to 27 N·m (20 lb-ft). Recheck clearance after tightening locknut. Readjust clearance as necessary

5. Reinstall rocker arm cover and crankcase vent tube.

- **4-Cylinder Engine:**

NOTE: Firing order is 1-3-4-2

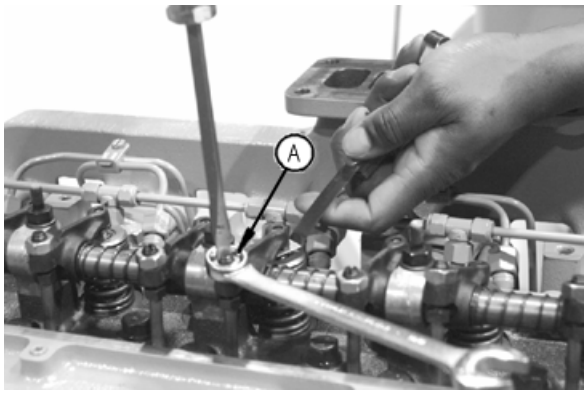
a. Lock No. 1 piston at TDC compression stroke (B).
b. Adjust valve clearance on No. 1 and 3 exhaust valves and No.1 and 2 intake valves.
c. Rotate flywheel 360°. Lock No. 4 piston at TDC compression stroke (C).
d. Adjust valve clearance on No. 2 and 4 exhaust valves and No. 3 and 4 intake valves.

- **6-Cylinder Engine:**

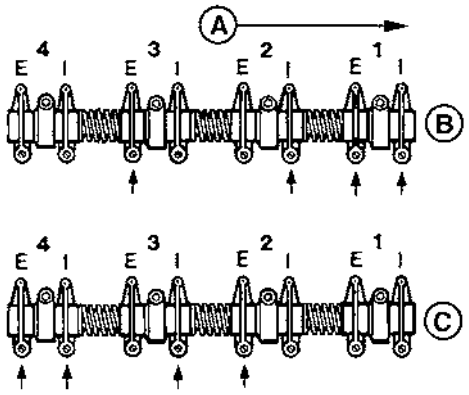
NOTE: Firing order is 1-5-3-6-2-4.

a. Lock No. 1 piston at TDC compression stroke (B).
b. Adjust valve clearance on No. 1, 3, and 5 exhaust valves and No. 1, 2, and 4 intake valves.
c. Rotate flywheel 360°. Lock No. 6 piston at TDC compression stroke (C).
d. Adjust valve clearance on No. 2, 4, and 6 exhaust valves and No. 3, 5, and 6 intake valves.

A—Front of engine
B—No.1 Piston at TDC compression stroke
C—No.6 Piston at TDC compression stroke
E—Exhaust valve
I— Intake valve

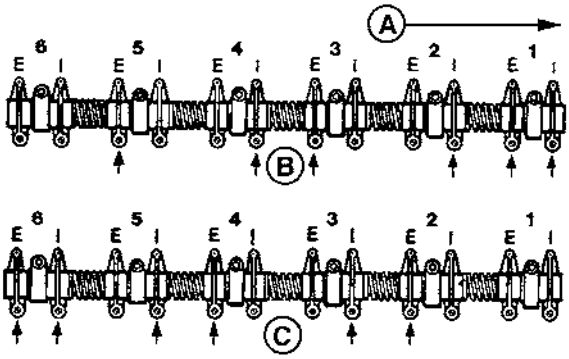


RG7409 —UN—06AUG96



RG4776 —UN—31OCT97

A—Front of engine
B—No.1 Piston at TDC compression stroke
C—No.4 Piston at TDC compression stroke
E—Exhaust valve
I— Intake valve



RG4777 —UN—31OCT97

DPSG,CD03523,36 -19-31JAN07-2/2

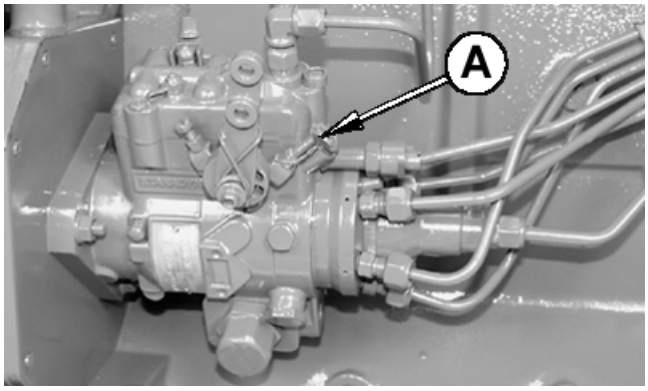
Checking engine speed (Mechanical fuel system)

NOTE: Most engines for generator set application (1500 rpm for 50 Hz or 1800 rpm for 60 Hz) run only at fast idle and therefore they do not have slow idle.

Specification

Fast idle—50 Hz Generator set	1550—1580 rpm
60 Hz Generator set	1865—1890 rpm

NOTE: Fast idle is settled by the factory then the idle adjusting screw (A) is sealed to prevent from tampering. Fast idle adjustment can only be done by an authorized fuel system agent.



CD30763 —UN—24SEP99

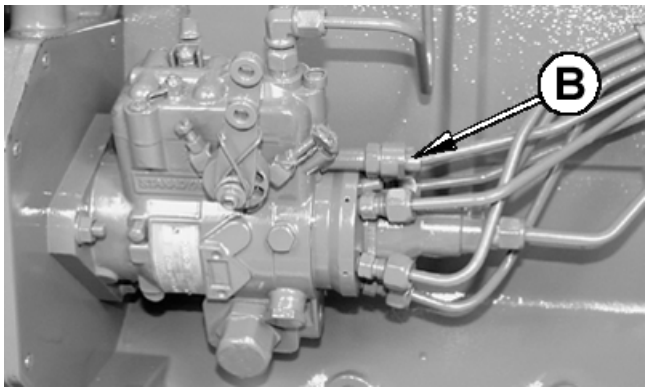
A—Fast idle adjusting screw

DPSG,CD03523,38 -19-31JAN07-1/1

Adjust speed droop governor (Mechanical fuel system)

1. Warm engine to normal operating temperature.
2. Run engine at fast idle.
3. Apply full load.
4. If specified power cannot be obtained, turn screw (B) to adjust droop until the requested power is reached.

NOTE: If surging exits upon removing the load, turn screw (B) clockwise to eliminate.



CD30764 —UN—24SEP99

B—Speed droop governor adjusting screw

DPSG,CD03523,39 -19-31JAN07-1/1

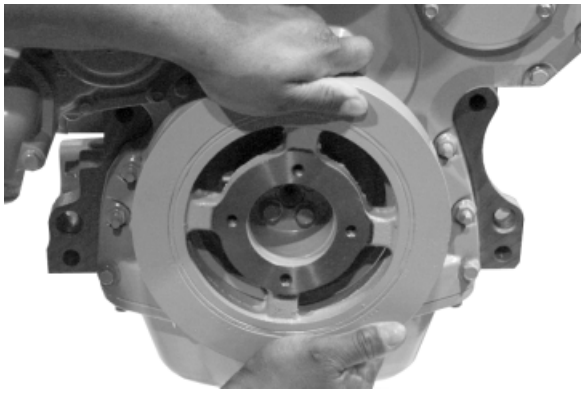
Checking crankshaft vibration damper (6-CYLINDER ENGINE ONLY)

1. Remove belts (shown removed).
2. Grasp vibration damper with both hands and attempt to turn it in both directions. If rotation is felt, damper is defective and should be replaced.

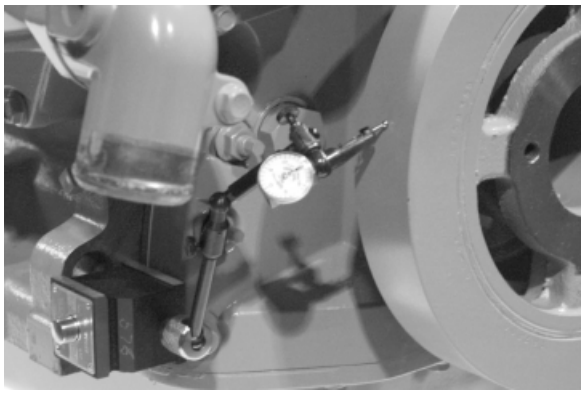
IMPORTANT: The vibration damper assembly is not repairable and should be replaced every 4500 hours or 5 years, whichever occurs first.

3. Check vibration damper radial runout by positioning a dial indicator so probe contacts damper outer circumference.
4. With engine at operating temperature, rotate crankshaft using JDG820 or JDE83 Flywheel Turning Tool.
5. Note dial indicator reading. If runout exceeds specifications given below, replace vibration damper.

Specification	
Damper—Maximum radial runout	1.50 mm (0.060 in.)



RG8018 —UN—15JAN99



RG7508 —UN—23NOV97

DPSG,CD03523,40 -19-22JAN07-1/1

Drain and flush cooling system

NOTE: Drain and flush cooling system every 2500 hours/3 years when John Deere COOL-GARD coolant is used. Otherwise every 2000 hours/2 years

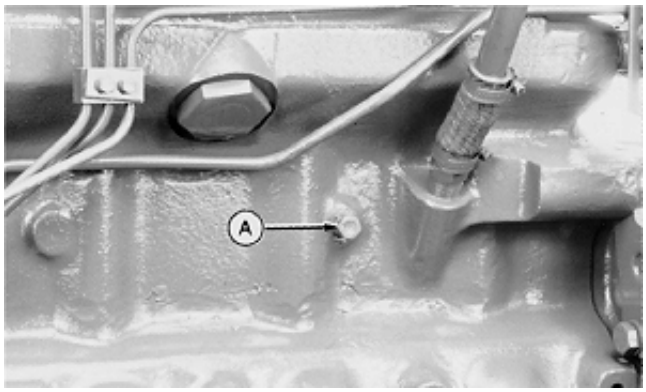
CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

TS281 —UN—23AUG88

DPSG,CD03523,41 -19-15JUL09-1/5

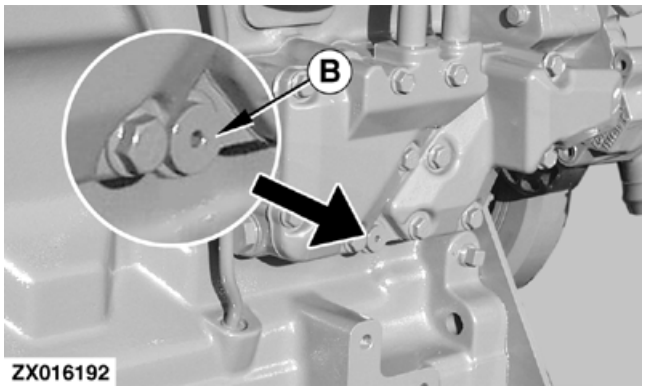
1. Slowly open the radiator cap.
2. Remove engine block drain plug (A).



RG4894 —UN—14DEC88

DPSG,CD03523,41 -19-15JUL09-2/5

3. On POWERTech engines, remove oil cooler housing drain plug (B).



ZX016192 —UN—11JAN99

Continued on next page

DPSG,CD03523,41 -19-15JUL09-3/5

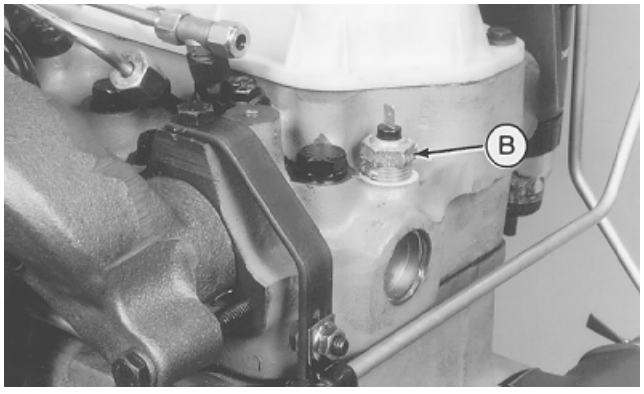
4. Open radiator drain valve (C). Drain all coolant from radiator.
5. Close all drain orifices after coolant has drained.
6. Fill the cooling system with clean water. Run engine until water passes through the thermostat to stir up possible rust or sediment.
7. Stop engine and immediately drain the water from system before rust and sediment settle.
8. After draining water, close all drain orifices and fill the cooling system with cleaning product such as PMCC2610 or PMCC2638 Cooling System Cleaners available from your John Deere Dealer. Follow manufacturer's directions on label.
9. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run engine until water passes through the thermostat, then drain out flushing water.
10. Check cooling system hoses for proper condition. Replace as necessary.
11. Close all drain orifices and fill the cooling system with specified coolant (see DIESEL ENGINE COOLANT).

CD30765 —UN—27AUG99

Cooling system capacity	
Engine Model	Cooling system capacity
3029DF128, 3029TF120, 3029TF158, 3029HFS70, 3029TF270, 3029TFS70, 3029HFU70, 3029TFU70	14.5 L (15.5 qt)
4039DF008, 4039TF008,	16.5 L (17.5 qt)
4045DF158	20 L (21 qt)
4045TF120, 4045TF158, 4045TF220, 4045TF258, 4045HFS80, 4045TF270, 4045TFS70, 4045TFU70	25 L (26.5 qt)
4045HF158, 4045HFU72, 6068TF158, 6068TF258	28 L (29.5 qt)
4045HFS73, 4045HFS82, 4045HFS83, 4045HFU79,6068HF120, 6068HF158, 6068HF220, 6068HF258, 6068HF275, 6068HFS72, 6068HFS73, 6068HFS82, 6068HFS83, 6068HFU72, 6068HFU79	32 L (34 qt)
6068HF475, 6068HFS76, 6068HFS77, 6068HFS89, 6068HFU74	35 L (37 qt)

DPSG,CD03523,41 -19-15JUL09-4/5

12. When refilling cooling system, loosen temperature sensor (B) or plug at the rear of cylinder head to allow air to escape.
13. Run engine until it reaches operating temperature then check coolant level and entire cooling system for leaks.



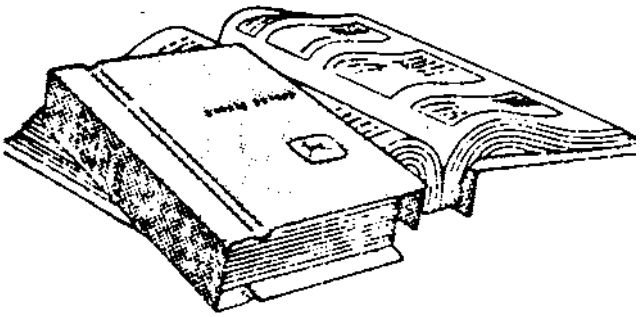
CD30643 —UN—04MAY98

DPSG,CD03523,41 -19-15JUL09-5/5

Additional service information

This manual does not allow a complete repair of your engine. If you want want more detailed service information the following publications are available from your regular parts channel.

- PC2451 — Parts Catalog for Non-Emission Certified engines
- PC3235 — Parts Catalog for Stage II Emission Certified engines
- CTM3274 — Component Technical Manual for 3029 and 4039 engines (English)
- CTM104 — Component Technical Manual for 4045 and 6068 base engines (English)
- CTM207 — Component Technical Manual for Mechanical Fuel Systems on 4045 and 6068 engines (English)
- CTM320 — Component Technical Manual for HPCR Fuel System on 4045 and 6068 with 4-Valve Head Engines (English)
- CTM331 — Component Technical Manual for DE10 Fuel Systems on 4045 and 6068 engines (English)



RG4624 —UN—15DEC88

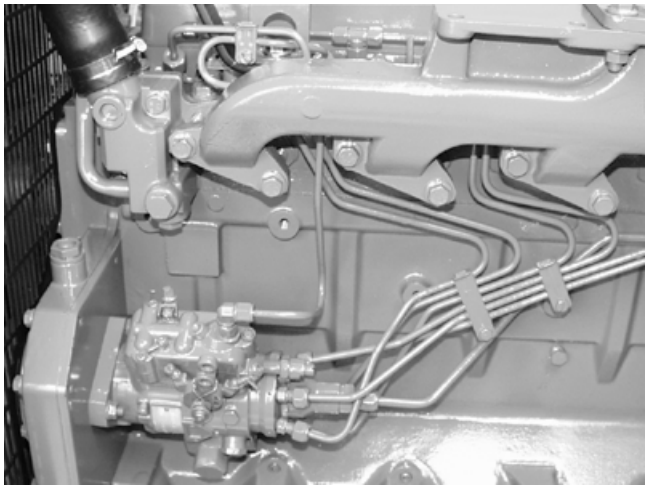
- CTM502 — Component Technical Manual for HPCR Fuel System on 4045 and 6068 with 2-Valve Head Engines (English)
- CTM67 — Component Technical Manual for OEM Engine accessories (English only)
- CTM77 — Component Technical Manual for Alternators and Starter Motors (English only)

DPSG,CD03523,42 -19-31JAN07-1/1

Do not modify fuel system

IMPORTANT: Modification or alteration of the injection pump, the injection pump timing, or the fuel injectors in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

Do not attempt to service injection pump or fuel injectors yourself. Special training and special tools are required. (See your authorized servicing dealer or engine distributor.)



CD30768 —UN—24SEP99

DPSG,CD03523,43 -19-22JAN07-1/1

Welding Near Electronic Control Units

IMPORTANT: Do not jump-start engines with arc welding equipment. Currents and voltages are too high and may cause permanent damage.

1. Disconnect the negative (-) battery cable.
2. Disconnect the positive (+) battery cable.
3. Short the positive and negative terminals together. Do not attach to vehicle frame.
4. Clear or move any wiring harness sections away from welding area.
5. Connect welder ground close to welding point and away from control units.

TS953 —UN—15MAY90

6. After welding, reverse Steps 1—5.

DX,WW,ECU02 -19-11JUN09-1/1

Keep Electronic Control Unit Connectors Clean

IMPORTANT: Do not open control unit and do not clean with a high-pressure spray. Moisture, dirt, and other contaminants may cause permanent damage.

1. Keep terminals clean and free of foreign debris. Moisture, dirt, and other contaminants may cause the terminals to erode over time and not make a good electrical connection.
2. If a connector is not in use, put on the proper dust cap or an appropriate seal to protect it from foreign debris and moisture.
3. Control units are not repairable.
4. Since control units are the components LEAST likely to fail, isolate failure before replacing by completing a diagnostic procedure. (See your John Deere dealer.)

RG16946 —UN—31MAR09

5. The wiring harness terminals and connectors for electronic control units are repairable.

DX,WW,ECU04 -19-11JUN09-1/1

Clean or replace air filter (one-piece)

Clean air filter when restriction indicator (A) is red. Air filter can be cleaned up to six times. Thereafter, or at least once a year, it must be replaced.

Proceed as follows:

1. Thoroughly clean all dirt around air filter area.
2. Loosen clamp (B) then remove air filter.

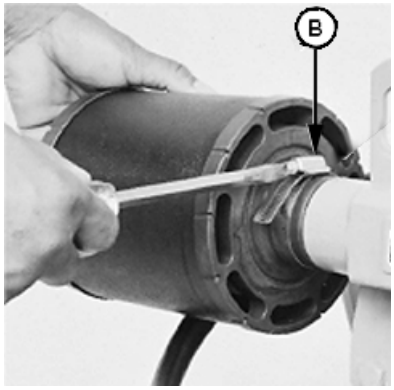
IMPORTANT: Never reinstall an air filter which shows evidence of bad condition (punched, dented...) allowing no filtered air to enter the engine.

3. Clean air filter with compressed air working from ”clean” to ”dirty” side.

NOTE: Compressed air pressure must not exceed 600 kPa (6 bar; 88 psi).

4. Mark air filter to keep track of each cleaning operation.
5. Fully depress air restriction indicator reset button and release to reset indicator.
6. Check air system entirely for proper condition (see CHECKING AIR INTAKE SYSTEM).

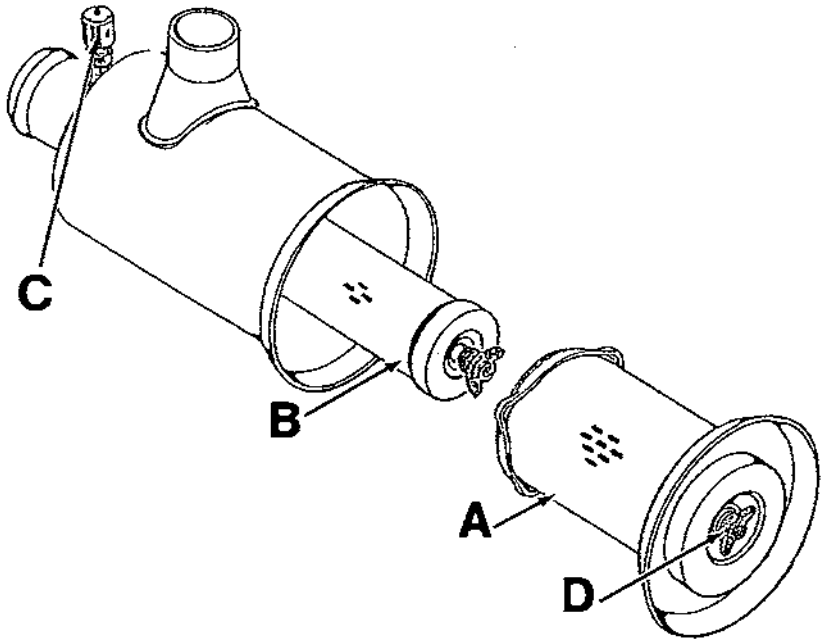
CD30766 —UN—06SEP99



RG9912 —UN—25FEB99

DPSG,CD03523,44 -19-22JAN07-1/1

Clean or replace air filter element



CD30772 —UN—27AUG99

A—Primary element **B—Secondary (safety) element** **C—Air restriction indicator** **D—Wing nut**

Clean air filter when restriction indicator (C) is red. Replace both primary (A) and secondary (B) filter elements after primary element has been cleaned six times or at least once a year.

Proceed as follows:

1. Thoroughly clean all dirt around air filter area.
2. Remove wing nut (D) and remove primary element (A) from canister.

IMPORTANT: Do not attempt to clean the secondary (safety) element (B). It must be only replaced as recommended.

3. Thoroughly clean all dirt from inside canister.

IMPORTANT: If primary element shows evidence of bad condition (punched, dented...), replace both the primary and the secondary elements.

4. Clean primary element with compressed air working from ”clean” to ”dirty” side.

NOTE: Compressed air pressure must not exceed 600 kPa (6 bar; 88 psi).

5. Mark air filter to keep track of each cleaning operation.
6. Fully depress air restriction indicator reset button and release to reset indicator.
7. Check air system entirely for proper condition (see CHECKING AIR INTAKE SYSTEM).

DPSG,CD03523,58 -19-22JAN07-1/1

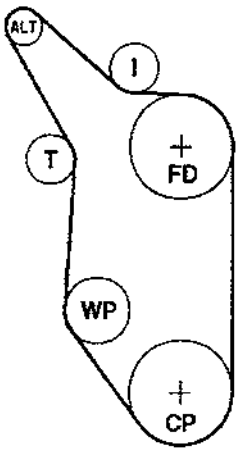
Replacing fan and alternator belt (4045 and 6068 Engines)

NOTE: Refer to CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR for additional information on the belt tensioner.

1. Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.
2. On engines with automatic belt tensioner, release tension on belt using a breaker bar and socket on tension arm.

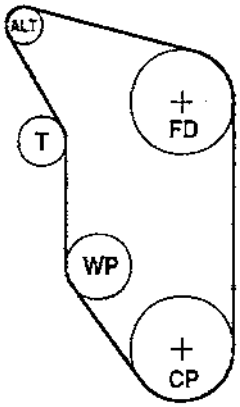
   On engines with manual tensioner, loosen cap screws holding the alternator.
3. Remove poly V-belt from pulleys and discard belt.
4. Install new belt, making sure belt is correctly seated in all pulley grooves. Refer to belt routing at right for your application.
5. Apply tension to belt (See CHECKING BELT).
6. Start engine and check belt alignment.

ALT— Alternator
CP—Crank Pulley
FD—Fan Drive
I— Idler Pulley
T—Tensioner
WP—Water Pump



CD30769 —UN—01SEP99

Installation on 4045 engines



CD30770 —UN—01SEP99

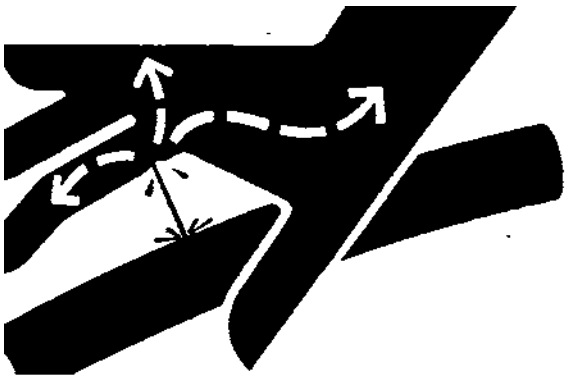
Installation on 6068 engines

DPSG,CD03523,45 -19-31JAN07-1/1

Bleeding the fuel system

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



X9811 —UN—23AUG88

NOTE: Engines with mechanical fuel system have a single fuel filter while electronically controlled engines (DE10 and HPCR fuel systems) have two fuel filters (primary and final). Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system. On dual fuel filter system, bleed air only from final filter.

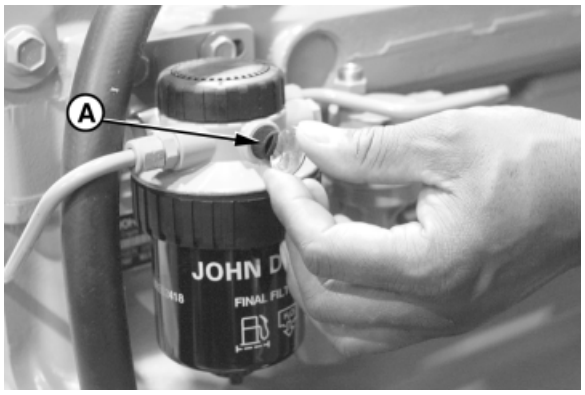
Continued on next page

DPSG,CD03523,46 -19-09FEB07-1/3

A.) Mechanical and DE10 fuel systems

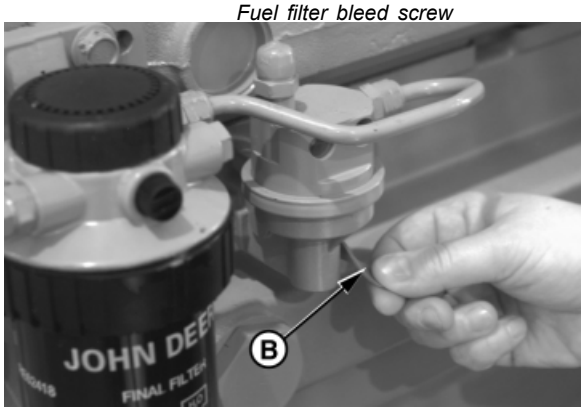
1. Loosen the air bleed screw (A) two full turns. On DE10 fuel system, loosen only air bleed screw on final fuel filter.
2. Operate supply pump primer lever (B) until fuel flow is free from air bubbles.
3. Tighten bleed screw securely, continue operating hand primer until pumping action is not felt.
4. Start engine and check for leaks.

If engine does not start, it will be necessary to bleed air from fuel system at fuel injection pump or injection nozzles as explained next.



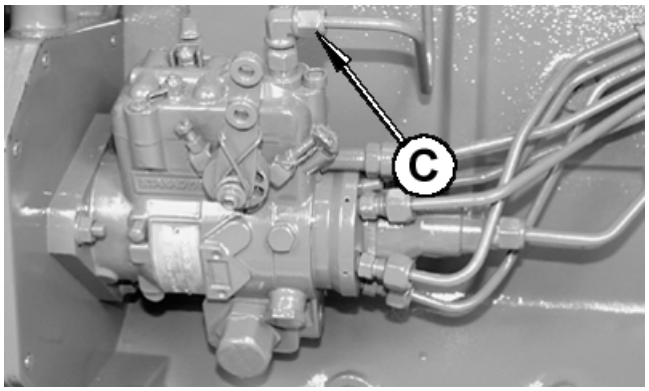
RG7947 —UN—13NOV97

Fuel filter bleed screw



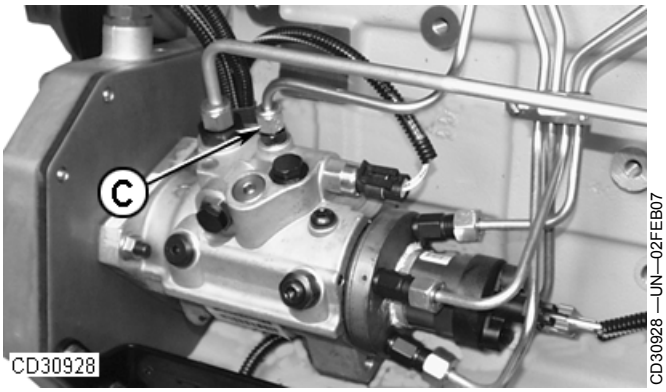
RG8013A —UN—15JAN99

Fuel pump primer lever



CD30771 —UN—24SEP99

Mechanical injection pump return line



CD30928 —UN—02FEB07

DE10 Fuel return line

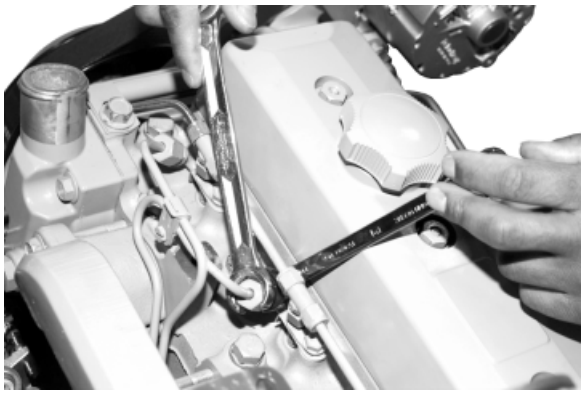
- **At Fuel Injection Pump:**
  a. Slightly loosen fuel return line connector (C) at fuel injection pump.
  b. Operate fuel supply pump primer lever until fuel, without air bubbles, flows from fuel return line connection.
  c. Securely tighten return line connector.

Continued on next page

DPSG,CD03523,46 -19-09FEB07-2/3

- **At Fuel Injection Nozzles:**
  a. Using two open-end wrenches, loosen fuel line connection at injection nozzle.
  b. Crank engine over with starting motor, (but do not start engine), until fuel free from bubbles flows out of loosened connection. Retighten connection to 27 N·m (20 lb-ft).
  c. Repeat procedure for remaining injection nozzles (if necessary) until all air has been removed from fuel system.

  If engine still will not start, see your authorized servicing dealer or engine distributor.



RG7725 —UN—08JAN97

Bleed fuel system at fuel injection nozzles

TS1343 —UN—18MAR92

RG12220 —UN—24MAY02

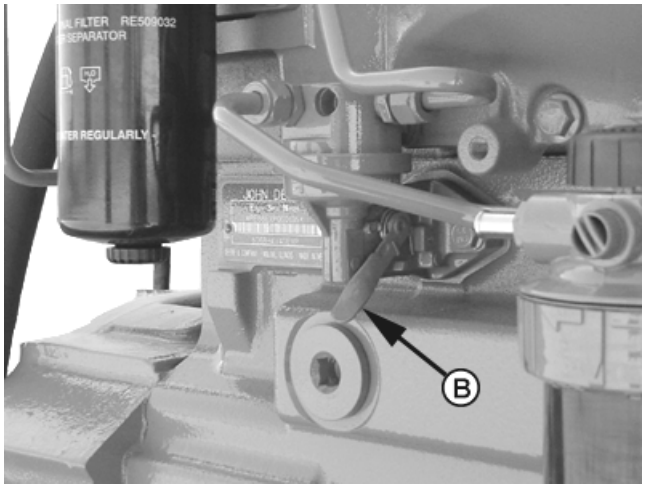
Final fuel filter bleed screw

B.) HPCR fuel system (2 or 4-valve head)

⚠ CAUTION: High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect fuel lines between the high pressure fuel pump and nozzles. Only bleed the fuel system at the fuel filter bleed screw (A).

1. Loosen the air bleed screw (A) two full turns on final filter base only.
2. Operate fuel supply pump primer lever (B) until fuel flow is free from air bubbles.
3. Tighten bleed screw securely. Continue operating primer until pumping action is not felt.
4. Start engine and check for leaks.

If engine will not start, repeat steps 1-4.



RG12221 —UN—24MAY02

Fuel supply pump primer lever

DPSG,CD03523,46 -19-09FEB07-3/3

General troubleshooting information

Troubleshooting electronically controlled engine problems can be difficult. The first thing to do is to identify the type of problem which can be mechanical or electrical.

An engine wiring layout is provided in this section to identify electrical components (engine controller, sensors, connectors...).

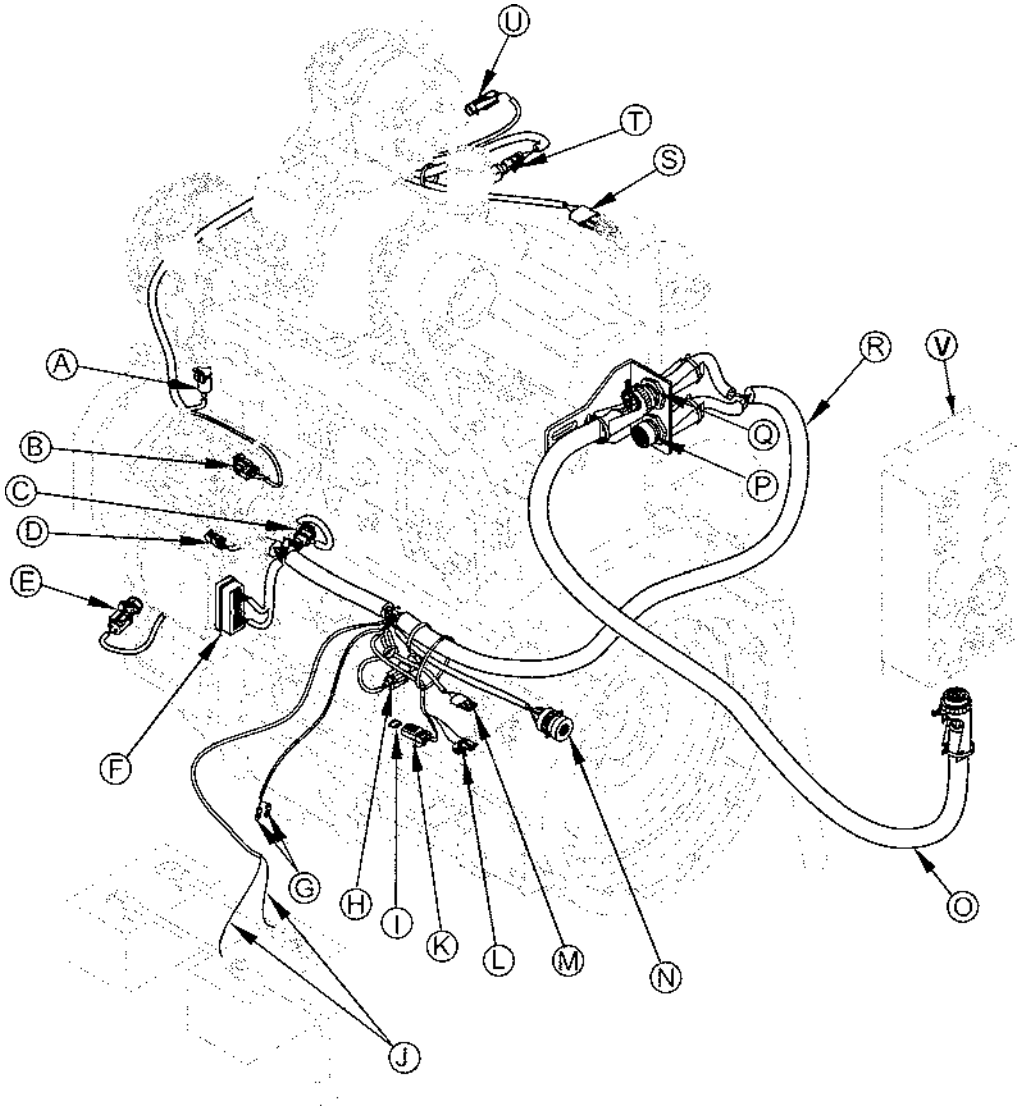
Later in this section is a list of possible engine problems and diagnostic trouble codes that may be encountered accompanied by possible causes and corrections. This troubleshooting information is of a general nature. See also the generator documentation for a complete information of your application.

A reliable program for troubleshooting engine problems should include the following basic diagnostic thought process:

- Know the engine and all related systems.
- Study the problem thoroughly.
- Relate the symptoms to your knowledge of engine and systems.
- Diagnose the problem starting with the easiest things first.
- Double-check before beginning the disassembly.
- Determine cause and make a thorough repair.
- After making repairs, operate the engine under normal conditions to verify that the problem and cause was corrected.

CD03523,000018D -19-08FEB07-1/1

Engine Wiring Layout (Electronic Fuel System With Stanadyne DE10 Injection Pump)

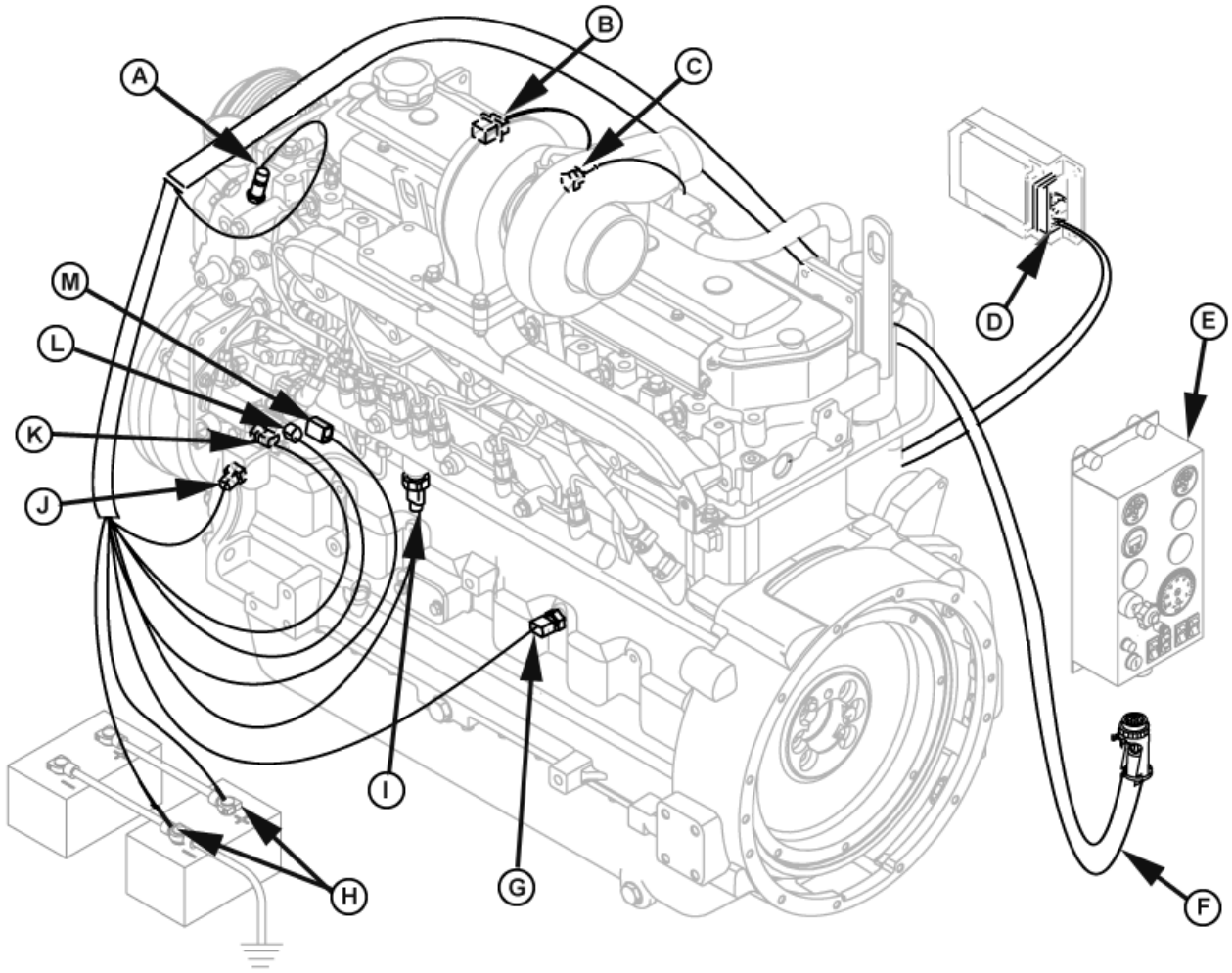


RG12201 —UN—24MAY02

A—Coolant Temperature Sensor Connector
B—Fuel Temperature Sensor Connector
C—Injection Pump Solenoid Connector
D—SAE 1939 CAN Connector
E—Crankshaft Position Sensor Connector
F—ECU Connector
G—Starter Relay Connector
H—Oil Pressure Sensor Connector
I— Main System Fuse (10 amp)
J— Power and Ground Battery Connections
K—Fuse Holder
L—Transient Voltage Protection (TVP) Module Connector
M—Remote ON/ OFF Connector
N—CAN Network Diagnostic Connector
O—Instrument Panel Connector Harness
P—23-pin Optional Feature Connector (Extended-feature ECU only)
Q—21-pin Instrument Panel Connector
R—Engine Wiring Harness
S—Fuel Heater Connector
T—Manifold Air Temperature (MAT) Sensor Connector
U—Alternator Ignition Connector
V—Optional Instrument Panel or Generator Instrument Panel

CD03523,000018E -19-02FEB07-1/1

Engine Wiring Layout (Electronic Fuel System With Denso High Pressure Common Rail)



6068HFU74 Engine shown

A—Engine Coolant Temperature (ECT) Sensor
B—Electronic Injector Connector
C—Manifold Air Temperature (MAT) Sensor
D—ECU Connector
E—Optional Instrument Panel or Generator Instrument Panel
F—Engine Wiring Harness
G—Engine Oil Pressure Sensor Connector
H—Power and Ground Battery Connections
I— Fuel Rail Pressure Sensor
J— Crankshaft Position Sensor
K—Pump Position Sensor
L—Pump Control Valve Solenoid
M—Fuel Temperature Sensor

CD03523,000018F -19-02FEB07-1/1

Engine troubleshooting

Symptom	Problem	Solution
Engine cranks but will not start	Incorrect starting procedure.	Verify correct starting procedure.
	No fuel.	Check fuel in tank and manual shut-off valve.
	Exhaust restricted.	Check and correct exhaust restriction.
	Fuel filter plugged or full of water.	Replace fuel filter or drain water from filter.
	Injection pump not getting fuel or air in fuel system.	Check fuel flow at supply pump or bleed fuel system.
	Faulty injection pump or nozzles.	Consult authorized diesel repair station for repair or replacement.
Engine hard to start or will not start	Engine starting under load.	Remove load.
	Improper starting procedure.	Review starting procedure.
	No fuel.	Check fuel tank.
	Air in fuel line.	Bleed fuel line.
	Cold weather.	Use cold weather starting aids.
	Slow starter speed.	See ”Starter Cranks Slowly”.
	Crankcase oil too heavy.	Use oil of proper viscosity.
	Improper type of fuel.	Consult fuel supplier; use proper type fuel for operating conditions.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Clogged fuel filter.	Replace filter element.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection pump shut-off not reset.	Turn key switch to ”OFF” then to ”ON”.
Engine knocks	Low engine oil level.	Add oil to engine crankcase.
	Injection pump out of time.	See your authorized servicing dealer or engine distributor.
	Low coolant temperature.	Remove and check thermostat.
	Engine overheating.	See ”Engine Overheats”.

Continued on next page

Symptom	Problem	Solution
Engine runs irregularly or stalls frequently	Low coolant temperature.	Remove and check thermostat.
	Clogged fuel filter.	Replace fuel filter element.
	Water, dirt, or air in fuel system.	Drain, flush, fill, and bleed system.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
Below normal engine temperature	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check gauge, sender, and connections.
Lack of power	Engine overloaded.	Reduce load.
	Intake air restriction.	Service air cleaner.
	Clogged fuel filter.	Replace filter elements.
	Improper type of fuel.	Use proper fuel.
	Overheated engine.	See ”Engine Overheats”.
	Below normal engine temperature.	Remove and check thermostat.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Dirty or faulty injection nozzles.	Have authorized servicing dealer or engine distributor check injectors.
	Injection pump out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.
	Leaking exhaust manifold gasket.	See your authorized servicing dealer or engine distributor.
	Defective aneroid control line.	See your authorized servicing dealer or engine distributor.
	Restricted fuel hose.	Clean or replace fuel hose.
	Low fast idle speed.	See your authorized servicing dealer or engine distributor.
Low oil pressure	Low oil level.	Add oil.

Continued on next page

Symptom	Problem	Solution
	Improper type of oil.	Drain, fill crankcase with oil of proper viscosity and quality.
High oil consumption	Crankcase oil too light.	Use proper viscosity oil.
	Oil leaks.	Check for leaks in lines, gaskets, and drain plug.
	Restricted crankcase vent tube.	Clean vent tube.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
Engine emits white smoke	Improper type of fuel.	Use proper fuel.
	Low engine temperature.	Warm up engine to normal operating temperature.
	Defective thermostat.	Remove and check thermostat.
	Defective injection nozzles.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
Engine emits black or gray exhaust smoke	Improper type of fuel.	Use proper fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.
Engine overheats	Engine overloaded.	Reduce load.
	Low coolant level.	Fill radiator to proper level, check radiator and hoses for loose connections or leaks.
	Faulty radiator cap.	Have serviceman check.
	Stretched poly V-belt or defective belt tensioner.	Check automatic belt tensioner and check belts for stretching. Replace as required.

Continued on next page

Symptom	Problem	Solution
	Low engine oil level.	Check oil level. Add oil as required.
	Cooling system needs flushing.	Flush cooling system.
	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check water temperature with thermometer and replace, if necessary.
	Incorrect grade of fuel.	Use correct grade of fuel.
High fuel consumption	Improper type of fuel.	Use proper type of fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
	Low engine temperature.	Check thermostat.

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Electrical troubleshooting

Symptom	Problem	Solution
Undercharged system	Excessive electrical load from added accessories.	Remove accessories or install higher output alternator.
	Excessive engine idling.	Increase engine rpm when heavy electrical load is used.
	Poor electrical connections on battery, ground strap, starter, or alternator.	Inspect and clean as necessary.
	Defective battery.	Test battery.
	Defective alternator.	Test charging system.
Battery uses too much water	Cracked battery case.	Check for moisture and replace as necessary.
	Defective battery.	Test battery.
	Battery charging rate too high.	Test charging system.
Batteries will not charge	Loose or corroded connections.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Stretched poly V-belt or defective belt tensioner.	Adjust belt tension or replace belts.
Starter will not crank	Engine under load	Remove load
	Loose or corroded connections.	Clean and tighten loose connections.
	Low battery output voltage.	See your authorized servicing dealer or engine distributor.
	Faulty start circuit relay.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.
Starter cranks slowly	Low battery output.	See your authorized servicing dealer or engine distributor.
	Crankcase oil too heavy.	Use proper viscosity oil.
	Loose or corroded connections.	Clean and tighten loose connections.
Entire electrical system	Faulty battery connection.	Clean and tighten connections.

Continued on next page

Symptom	Problem	Solution
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.

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Displaying Of Diagnostic Trouble Codes (DTCs)

There are several different methods for displaying both stored and active DTCs from the ECU via a fault lamp or a diagnostic gauge on the electronic instrument panel.

2-DIGIT CODES

Some engines display Service Codes or DTCs as 2-digit codes read from a fault lamp which gives blink codes.

SPN/FMI CODES

Stored and active diagnostic trouble codes are output on the diagnostic gauge on the Deere electronic instrument panel according to the J1939 standard as a two-part code as shown on the tables on the following pages.

The first part is a six-digit Suspect Parameter Number (SPN) followed by a two-digit Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example SPN 000110 indicates a failure in the engine coolant temperature circuit.

The FMI identifies the type of failure that has occurred; for example FMI 03 indicates value above normal. Combining SPN 000110 with FMI 03 yields engine coolant temperature input voltage too high, or the equivalent of 2-digit fault code 18.

If diagnosing an application that shows DTCs as SPNs and FMIs, using the following list, determine the equivalent 2-digit code and have your dealer use the diagnostic procedure in the component technical manual for that 2-digit code.

Always contact your servicing dealer for help in correcting diagnostic trouble codes which are displayed for your engine.

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Using blink code method for retrieving Diagnostic Trouble Codes (DTC's)

NOTE: The method below applies to applications having a fault lamp on instrument panel (refer to the generator documentation for more information).

The Electronic Control Unit (ECU) has the ability to display DTCs using blinking sequence of the fault lamp.

NOTE: The ECU blinks the codes in 2-digit codes only. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) later in this Group.

1. Press down Override Shutdown Switch while turning the ignition switch "ON".
2. The Fault Lamp will begin to flash a code number. For example, flash three times...short pause...flash two times...long pause. This example is code 32.
3. The ECU begins the flashing sequence by flashing a code 32, this indicates the start of blinking active codes. If there are any active DTCs, the ECU will flash its 2–digit number. If there is more than one active DTC, the ECU will flash each code in numerical order. If there are no active DTCs, the Fault Lamp will flash a code 88.
4. Following the active codes, the Fault Lamp will flash a code 33. This indicates the start of blinking stored codes. If there are any stored DTCs, the Fault Lamp will flash its 2–digit number. If there is more than one stored DTC, the ECU will flash each code in numerical order. If there are no stored DTCs, the Fault Lamp will flash a code 88.
5. Once complete, this sequence will repeat.
6. When complete, turn ignition "OFF".

As an example, if an engine had an active DTC 18 and stored DTC 53, the flashing sequence would be: flash three times...short pause...flash two times...long pause...flash one time...short pause...flash eight times...long pause...flash three times...short pause...flash three times...long pause...flash five times...short pause...flash three times.

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Using diagnostic gauge for retrieving Diagnostic Trouble Codes (DTC's)

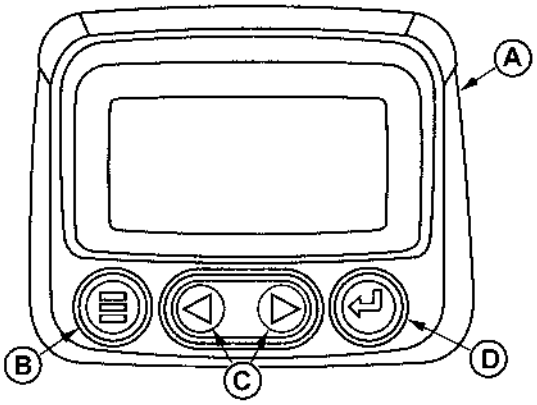
NOTE: The method below applies on applications having the optional diagnostic gauge shown (refer to the generator documentation for more information).

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly. (See ENGINE TROUBLESHOOTING in this section).

NOTE: Diagnostic gauge (A) uses the menu key (B) to access various engine functions, two arrow keys (C) to scroll through the engine parameter list and view the menu list, and an enter key (D) for selecting highlighted items.

2. Read and record DTC(s) displayed on LCD of diagnostic gauge (A). For procedure to access diagnostic trouble codes, refer to "Using Diagnostic Gauge to Access Engine Information", earlier in this manual.

3. Go to the LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) later in this section, to interpret the DTC(s) present.



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Trouble Code Display On Instrument Panel

A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Enter Key

4. Contact your nearest engine distributor or servicing dealer with a list of DTC(s) so that necessary repairs can be made.

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Listing of Diagnostic Trouble Codes (DTCs)

Trouble Codes

NOTE: Not all of these codes are used on all OEM engine applications

SPN	FMI	Description of Fault	Corrective Action
000028	03	Throttle #3 Signal Out of Range High	Check Sensor and Wiring
	04	Throttle #3 Signal Out of Range Low	Check Sensor and Wiring
000029	03	Throttle #2 Signal Out of Range High	Check Sensor and Wiring
	04	Throttle #2 Signal Out of Range Low	Check Sensor and Wiring
000084	31	Vehicle Speed Signal Unreliable	Contact Servicing Dealer
000091	03	Throttle #1 Signal Out of Range High	Check Switch and Wiring
	04	Throttle #1 Signal Out of Range Low	Check Switch and Wiring
	09	Throttle #1 Communication Signal Erratic	Check Sensor and Wiring
000094	03	Low Pressure Fuel Signal Out of Range High	Check Sensor and Wiring
	04	Low Pressure Fuel Signal Out of Range Low	Check Sensor and Wiring
	10	Low Pressure Fuel Rate of Change Abnormal	Contact Servicing Dealer
	13	Low Pressure Fuel Out of Calibration	Contact Servicing Dealer
	17	High Pressure Fuel System- Pressure Slightly Low	Contact Servicing Dealer
000097	00	Water in Fuel Continuously Detected	Contact Servicing Dealer
	03	Water-in-Fuel Signal Out of Range High	Check Sensor and Wiring
	04	Water-in-Fuel Signal Out of Range Low	Check Sensor and Wiring
	16	Water in Fuel Detected	Stop and Drain Water Separator
000100	01	Engine Oil Pressure Signal Extremely Low	Check Oil Level
	03	Engine Oil Pressure Signal Out of Range High	Check Sensor and Wiring
	04	Engine Oil Pressure Signal Out of Range Low	Check Sensor and Wiring
	18	Engine Oil Pressure Signal Moderately Low	Check Oil Level
000105	00	Intake Manifold Air Temperature Signal Extremely High	Check Air Cleaner, Aftercooler, or Room Temperature
	03	Intake Manifold Air Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Intake Manifold Air Temperature Signal Out of Range Low	Check Sensor and Wiring
	16	Intake Manifold Air Temperature Signal Moderately High	Check Air Cleaner, Aftercooler, or Room Temperature
000107	00	Air Filter Pressure Differential Extremely High	Check for plugged air filter
000110	00	Engine Coolant Temperature Signal Extremely High	Check Cooling System, Reduce Power
	03	Engine Coolant Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Engine Coolant Temperature Signal Out of Range Low	Check Sensor and Wiring
	15	Engine Coolant Temperature Signal Slightly High	Check Cooling System, Reduce Power
	16	Engine Coolant Temperature Signal Moderately High	Check Cooling System, Reduce Power
000111	01	Engine Coolant Level Low	Check Operator's Manual, "Adding Coolant"
000158	17	ECU Power Down Error (Internal ECU Problem)	Contact Servicing Dealer
000160	02	Axle Speed Signal Unreliable	Contact Servicing Dealer
000174	00	Fuel Temperature Signal Extremely High	Add Fuel or Switch Fuel Tanks
000174	03	Fuel Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Fuel Temperature Signal Out of Range Low	Check Sensor and Wiring
	16	Fuel Temperature Signal Moderately High	Add Fuel or Switch Fuel Tanks
000189	00	Engine Speed Derate Condition Exists	Check Fault Codes or Contact Servicing Dealer
000190	00	Engine Speed Extremely High	Reduce Engine Speed
	16	Engine Speed Moderately High	Reduce Engine Speed
000611	03	Injector Shorted to Power	Check Wiring
	04	Injector Shorted to Ground	Check Wiring
000620	03	Sensor Supply 2 Voltage High	Check Wiring
	04	Sensor Supply 2 Voltage Low	Check Wiring

Continued on next page

SPN	FMI	Description of Fault	Corrective Action
000627	01	All Injector Currents Are Low	Check Battery Voltage and Wiring
000629	13	ECU Programming Error	Contact Service Dealer
000636	02	Engine Position Sensor Signal Unreliable	Check Sensor and Wiring
	08	Engine Position Sensor Signal Missing	Check Sensor and Wiring
	10	Engine Position Sensor Signal Rate of Change Abnormal	Check Sensor and Wiring
000637	02	Engine Timing Sensor Signal Unreliable	Check Sensor and Wiring
	07	Engine Timing and Position Sensors Out of Sync	Check Sensor and Wiring
	08	Engine Timing Sensor Signal Missing	Check Sensor and Wiring
	10	Engine Timing Signal Rate of Change Abnormal	Check Sensor and Wiring
000639	13	CAN Bus Error (Communication network problem)	Contact Servicing Dealer
000651	05	Injector Number 1 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 1 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 1 Not Responding	Injector Failed or Flow Limiter Closed
000652	05	Injector Number 2 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 2 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 2 Not Responding	Injector Failed or Flow Limiter Closed
000653	05	Injector Number 3 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 3 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 3 Not Responding	Injector Failed or Flow Limiter Closed
000654	05	Injector Number 4 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 4 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 4 Not Responding	Injector Failed or Flow Limiter Closed
000655	05	Injector Number 5 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 5 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 5 Not Responding	Injector Failed or Flow Limiter Closed
000656	05	Injector Number 6 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector Number 6 Circuit Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	Injector Number 6 Not Responding	Injector Failed or Flow Limiter Closed
000898	09	Vehicle Speed or Torque Message Unreliable	Contact Servicing Dealer
000970	31	External Shutdown Commanded	Not Engine Fault. Check Other Shutdown Devices
000971	31	External Fuel Derate Switch Active	Not Engine Fault. Check Other Shutdown Devices
001069	09	Tire Size Invalid	Contact Servicing Dealer
	31	Tire Size Error	Contact Servicing Dealer
001079	03	Sensor Supply 1 Voltage High	Check Wiring
	04	Sensor Supply 1 Voltage Low	Check Wiring
001080	03	Fuel Rail Pressure Sensor Supply Voltage High	Check Wiring
	04	Fuel Rail Pressure Sensor Supply Voltage Low	Check Wiring
001109	31	Engine Protection Shutdown Warning	Shut Down Engine, Check Fault Codes
001110	31	Engine Protection Shutdown	Shut Down Engine, Check Fault Codes
001347	03	High Pressure Fuel Pump Control Valve Signal Out of Range High	Contact Servicing Dealer
	05	High Pressure Fuel Pump Solenoid Number 1 Circuit Has High Resistance	Check Pump Wiring
	07	High Pressure Fuel Pump Not Able to Meet Required Rail Pressure	Check Fuel Filter and Lines
001568	02	Requested Torque Curve Signal Unreliable	Contact Servicing Dealer
001569	31	Engine in Derate Condition	Check Fault Codes
002000	13	Security Violation	Contact Servicing Dealer

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Intermittent Fault Diagnostics (With Electronic Controls)

Intermittent faults are problems that periodically ”go away”. A problem such as a terminal that intermittently doesn’t make contact can cause an intermittent fault. Other intermittent faults may be set only under certain operating conditions such as heavy load, extended idle, etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors, since a high percentage of intermittent problems originate here. Check for loose, dirty or disconnected connectors. Inspect the wiring routing, looking for possible shorts caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity, looking for wires that have pulled out of connectors, poorly positioned terminals, damaged connectors and corroded or damaged splices and terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgement if component replacement is thought to be required.

NOTE: The engine control unit (ECU) is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

- If the problem is intermittent, try to reproduce the operating conditions that were present when the diagnostic trouble code (DTC) set.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the diagnostic gauge to see if the fault resets.

Possible causes of intermittent faults:

- Faulty connection between sensor or actuator harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc., can cause faulty signals to be sent to the ECU.

NOTE: Refer also to generator documents for more information about connections and wirings.

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Storage

Engine storage guidelines

1. John Deere engines can be stored outside for up to three (3) months with no long term preparation IF COVERED BY WATERPROOF COVERING.
2. John Deere engines can be stored in a standard overseas shipping container for up to three (3) months with no long term preparation.
3. John Deere engines can be stored inside, warehoused, for up to six (6) months with no long term preparation.
4. John Deere engines expected to be stored more than six (6) months, long term storage preparation MUST BE taken. (See PREPARING ENGINE FOR LONG TERM STORAGE).

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Preparing engine for long term storage

The following storage preparations are good for long term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

IMPORTANT: Any time your engine will not be used for over six (6) months, the following recommendations for storing it and removing it from storage will help to minimize corrosion and deterioration.

1. Change engine oil and replace filter. Used oil will not give adequate protection. (See CHANGING ENGINE OIL AND FILTER).
2. Service air cleaner. (See CLEAN OR REPLACE AIR FILTER).
3. Draining and flushing of cooling system is not necessary if engine is to be stored only for several months. However, for extended storage periods of a year or longer, it is recommended that the cooling system be drained, flushed, and refilled. Refill with appropriate coolant. (See DIESEL ENGINE COOLANT).
4. Fill the fuel tank.
5. Remove fan/alternator belt, if desired.
6. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
7. Clean the exterior of the engine with salt-free water and touchup any scratched or chipped painted surfaces with a good quality paint.
8. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.
9. Seal all openings on engine with plastic bags and tape.
10. Store the engine in a dry protected place. If engine must be stored outside, cover it with a waterproof canvas or other suitable protective material and use a strong waterproof tape.

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Removing engine from long term storage

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

1. Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.
2. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
3. Install fan/alternator belt if removed.
4. Check for filled fuel tank.
5. Perform all appropriate prestarting checks. (See DAILY PRESTARTING CHECKS).

IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

6. Crank engine for 20 seconds with starter (do not allow the engine to start). Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.
7. Start engine and run at no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
8. On the first day of operation after storage, check overall engine for leaks and check all gauges for correct operation.

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General engine pack specifications (Non-Emission Certified Engines)

ITEM	UNIT OF MEASURE	3029DF120	3029DF128	3029TF120	3029TF158
Number of Cylinders		3	3	3	3
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	110	110	110	110
Displacement	L	2.9	2.9	2.9	2.9
Compression Ratio		17.2:1	17.2:1	17.2:1	17.2:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	27 (36)	26 (35)	38 (51)	36 (49)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	30 (41)	30 (41)	42 (56)	40 (54)
POWER[a] @ 1800 rpm (Prime)	kW (hp)	30 (41)	30 (41)	43 (58)	40 (54)
POWER[a] @ 1800 rpm (Standby)	kW (hp)	35 (47)	34 (46)	48 (64)	45 (61)
Width (overall)	mm	519	582	519	582
Length (overall)	mm	716	888	716	888
Height (overall)	mm	819	931	819	979
Weight (dry)[b]	kg	316	345	316	350
Engine oil quantity	L	6	6	8	8
Engine coolant quantity	L	14.5	14.5	14.5	14.5

[a] *With Fan*
[b] *Approximate*

ITEM	UNIT OF MEASURE	4039DF008	4039TF008	4045DF158	4045HF120	4045HF158
Number of Cylinders		4	4	4	4	4
Fuel		Diesel	Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5	106.5
Stroke	mm	110	110	127	127	127
Displacement	L	3.9	3.9	4.5	4.5	4.5
Compression Ratio		17.8:1	17.8:1	17.6:1	17.0:1	17.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	35 (48)	55 (75)	41 (56)	91 (122)	88 (120)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	38 (52)	61 (83)	42 (57)	102 (137)	96 (131)
POWER[a] @ 1800 rpm (Prime)	kW (hp)	41 (56)	67 (91)	48 (65)		108 (147)
POWER[a] @ 1800 rpm (Standby)	kW (hp)	47 (64)	73 (99)	51 (69)		120 (163)
Width (overall)	mm	588	588	606	598	798
Length (overall)	mm	1016	1016	1038	861	1209
Height (overall)	mm	960	979	959	980	1197
Weight (dry)[b]	kg	475	487	493	396	599
Engine oil quantity	L	12	12	8	12	12
Engine coolant quantity	L	16.5	16.5	20	28	28

[a] *With Fan*

Continued on next page

[b]*Approximate*

ITEM	UNIT OF MEASURE	4045TF120	4045TF158	4045TF220	4045TF258
Number of Cylinders		4	4	4	4
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	127	127	127	127
Displacement	L	4.5	4.5	4.5	4.5
Compression Ratio		17.0:1	17.0:1	17.0:1	17.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	63 (84)	61 (83)	75 (101)	72 (98)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	70 (94)	68 (92)	83 (111)	80 (109)
POWER[a] @ 1800 rpm (Prime)	kW (hp)		72 (98)	90 (121)	80 (109)
POWER[a] @ 1800 rpm (Standby)	kW (hp)		79 (107)	100 (134)	88 (120)
Width (overall)	mm	598	606	598	652
Length (overall)	mm	861	1191	861	1225
Height (overall)	mm	980	1027	980	1027
Weight (dry)[b]	kg	396	505	396	520
Engine oil quantity	L	12	12	12	12
Engine coolant quantity	L	25	25	25	25

[a]*With Fan*
[b]*Approximate*

ITEM	UNIT OF MEASURE	6068HF120 - 115	6068HF120 - 183	6068HF158	6068HF258
Number of Cylinders		6	6	6	6
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	127	127	127	127
Displacement	L	6.8	6.8	6.8	6.8
Compression Ratio		17.0:1	17.0:1	17.0:1	17.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	140 (188)	166 (223)	134 (182)	160 (218)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	155 (208)	183 (245)	148 (201)	177 (241)
POWER[a] @ 1800 rpm (Prime)	kW (hp)			164 (223)	179 (243)
POWER[a] @1800 rpm (Standby)	kW (hp)			187 (254)	200 (272)
Width (overall)	mm	623	623	798	798
Length (overall)	mm	1141	1141	1500	1500
Height (overall)	mm	1009	1009	1136	1204
Weight (dry)[b]	kg	569	569	705	764
Engine oil quantity	L	20	20	20	32
Engine coolant quantity	L	32	32	32	32

[a]*With Fan*
[b]*Approximate*

ITEM	UNIT OF MEASURE	6068TF158	6068TF220	6068TF258
Number of Cylinders		6	6	6

Continued on next page

DPSG,CD03523,55 -19-08JUL09-2/3

ITEM	UNIT OF MEASURE	6068TF158	6068TF220	6068TF258
Fuel		Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5
Stroke	mm	127	127	127
Displacement	L	6.8	6.8	6.8
Compression Ratio		17.0:1	17.0:1	17.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	92 (125)	109 (146)	105 (143)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	101 (137)	121 (162)	116 (158)
POWER[a] @ 1800 rpm (Prime)	kW (hp)	108 (147)		124 (169)
POWER[a] @1800 rpm (Standby)	kW (hp)	119 (162)		137 (186)
Width (overall)	mm	652	598	652
Length (overall)	mm	1364	1117	1364
Height (overall)	mm	1070	984	1070
Weight (dry)[b]	kg	651	533	651
Engine oil quantity	L	20	20	20
Engine coolant quantity	L	28	28	28

[a] *With Fan*
[b] *Approximate*

DPSG,CD03523,55 -19-08JUL09-3/3

General engine pack specifications (Stage II Emission Certified Engines)

ITEM	UNIT OF MEASURE	3029HFS70	3029HFU70	3029TFS70	3029TFU70
Number of Cylinders		3	3	3	3
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	110	110	110	110
Displacement	L	2.9	2.9	2.9	2.9
Compression Ratio		17.2:1	17.2:1	17.2:1	17.2:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	37 (50)	37 (50)	28 (37)	28 (37)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	41 (56)	41 (56)	31 (41)	31 (41)
POWER[a] @ 1800 rpm (Prime)	kW (hp)				
POWER[a] @1800 rpm (Standby)	kW (hp)				
Width (overall)	mm	582	582	582	582
Length (overall)	mm	888	888	888	888
Height (overall)	mm	974	974	974	974
Weight (dry)[b]	kg	350	350	350	350
Engine oil quantity	L	8	8	8	8
Engine coolant quantity	L	14.5	14.5	14.5	14.5

[a]With Fan
[b]Approximate

ITEM	UNIT OF MEASURE	4045HFS72	4045HFS73	4045HFU72	4045HFU79
Number of Cylinders		4	4	4	4
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	110	110	127	127
Displacement	L	4.5	4.5	4.5	4.5
Compression Ratio		17.0:1	19.0:1	17.0:1	19.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	75 (100)	94 (126)	75 (100)	94 (126)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	83 (111)	103 (138)	83 (111)	103 (138)
POWER[a] @ 1800 rpm (Prime)	kW (hp)				
POWER[a] @1800 rpm (Standby)	kW (hp)				
Width (overall)	mm	751	765	751	765
Length (overall)	mm	1362	1365	1362	1365
Height (overall)	mm	1137	1162	1137	1162
Weight (dry)[b]	kg	505	505	505	505
Engine oil quantity	L	16	16	16	16
Engine coolant quantity	L	28	32	28	32

[a]With Fan
[b]Approximate

Continued on next page

ITEM	UNIT OF MEASURE	4045TFS70	4045TFU70
Number of Cylinders		4	4
Fuel		Diesel	Diesel
Bore	mm	106.5	106.5
Stroke	mm	110	127
Displacement	L	4.5	4.5
Compression Ratio		17.0:1	17.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	55 (74)	55 (74)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	61 (81)	61 (81)
POWER[a] @ 1800 rpm (Prime)	kW (hp)		
POWER[a] @1800 rpm (Standby)	kW (hp)		
Width (overall)	mm	637	600
Length (overall)	mm	867	1230
Height (overall)	mm	979	1010
Weight (dry)[b]	kg	451	505
Engine oil quantity	L	12	12
Engine coolant quantity	L	25	25

[a]With Fan
[b]Approximate

ITEM	UNIT OF MEASURE	6068HFS72	6068HFS73	6068HFS76	6068HFS77
Number of Cylinders		6	6	6	6
Fuel		Diesel	Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5	106.5
Stroke	mm	127	127	127	127
Displacement	L	6.8	6.8	6.8	6.8
Compression Ratio		17.0:1	19.0:1	17.0:1	17.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	112 (150)	139 (186)	167 (224)	189 (253)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	123 (165)	153 (205)	184 (247)	207 (277))
POWER[a] @ 1800 rpm (Prime)	kW (hp)				
POWER[a] @1800 rpm (Standby)	kW (hp)				
Width (overall)	mm	784	784	960	960
Length (overall)	mm	1500	1500	1509	1509
Height (overall)	mm	1137	1137	1381	1381
Weight (dry)[b]	kg	764	764	764	764
Engine oil quantity	L	32	32	32	32
Engine coolant quantity	L	32	32	35	35

[a]With Fan
[b]Approximate

ITEM	UNIT OF MEASURE	6068HFU72	6068HFU74	6068HFU79
Number of Cylinders		6	6	6
Fuel		Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5
Stroke	mm	127	127	127

Continued on next page

ITEM	UNIT OF MEASURE	6068HFU72	6068HFU74	6068HFU79
Displacement	L	6.8	6.8	6.8
Compression Ratio		17.0:1	17.0:1	19.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)	111 (149)	166(223) / 188 (252)	139 (186)
POWER[a] @ 1500 rpm (Standby)	kW (hp)	123 (165)	184 (247) / 207 (277))	153 (205)
POWER[a] @ 1800 rpm (Prime)	kW (hp)		191(256)	
POWER[a] @1800 rpm (Standby)	kW (hp)		201 (269)	
Width (overall)	mm	784	960	812
Length (overall)	mm	1500	1509	1532
Height (overall)	mm	1137	1381	1200
Weight (dry)[b]	kg	764	764	764
Engine oil quantity	L	32	32	32
Engine coolant quantity	L	32	35	32

[a] *With Fan*
[b] *Approximate*

CD03523,0000194 -19-08JUL09-3/3

General engine pack specifications (EPA Tier 2 Emission Certified Engines)

ITEM	UNIT OF MEASURE	3029TF270	4045TF270	6068HF475
Number of Cylinders		3	4	6
Fuel		Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5
Stroke	mm	110	127	127
Displacement	L	2.9	4.5	6.8
Compression Ratio		17.2:1	17.0:1	17.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)			
POWER[a] @ 1500 rpm (Standby)	kW (hp)			
POWER[a] @ 1800 rpm (Prime)	kW (hp)	44 (59)	67 (90)	213 (286)
POWER[a] @1800 rpm (Standby)	kW (hp)	48 (64)	74 (99)	234 (314)
Width (overall)	mm	519	612	627
Length (overall)	mm	716	860	1161
Height (overall)	mm	819	994	1044
Weight (dry)[b]	kg	316	396	587
Engine oil quantity	L	8	12	32
Engine coolant quantity	L	14.5	25	35

[a] *With Fan*
[b] *Approximate*

CD03523,00001D3 -19-08JUL09-1/1

General engine pack specifications (EPA Tier 3 Emission Certified Engines)

ITEM	UNIT OF MEASURE	4045HFS80	4045HFS82	4045HFS83
Number of Cylinders		4	4	4
Fuel		Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5
Stroke	mm	127	127	110
Displacement	L	4.5	4.5	4.5
Compression Ratio		19.0:1	19.0:1	19.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)			
POWER[a] @ 1500 rpm (Standby)	kW (hp)			
POWER[a] @ 1800 rpm (Prime)	kW (hp)	67 (90)	85 (114)	107 (143)
POWER[a] @1800 rpm (Standby)	kW (hp)	74 (99)	94 (126)	118 (158)
Width (overall)	mm	600	765	765
Length (overall)	mm	1230	1365	1365
Height (overall)	mm	1010	1162	1162
Weight (dry)[b]	kg	505	505	505
Engine oil quantity	L	12	16	16
Engine coolant quantity	L	25	32	32

[a] *With Fan*
[b] *Approximate*

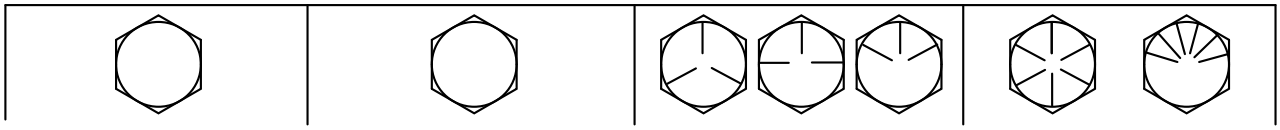
ITEM	UNIT OF MEASURE	6068HFS82	6068HFS83	6068HFS89
Number of Cylinders		6	6	6
Fuel		Diesel	Diesel	Diesel
Bore	mm	106.5	106.5	106.5
Stroke	mm	127	127	127
Displacement	L	6.8	6.8	6.8
Compression Ratio		19.0:1	19.0:1	17.0:1
POWER[a] @ 1500 rpm (Prime)	kW (hp)			
POWER[a] @ 1500 rpm (Standby)	kW (hp)			
POWER[a] @ 1800 rpm (Prime)	kW (hp)	134 (180)	161(216)	214 (287)
POWER[a] @1800 rpm (Standby)	kW (hp)	147 (197)	177 (237)	235 (315)
Width (overall)	mm	784	784	960
Length (overall)	mm	1500	1500	1509
Height (overall)	mm	1137	1137	1381
Weight (dry)[b]	kg	764	764	764
Engine oil quantity	L	32	32	32
Engine coolant quantity	L	32	32	35

[a] *With Fan*
[b] *Approximate*

CD03523,00001D4 -19-08JUL09-1/1

Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



Bolt or	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
Screw	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
Size	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N·m	lb-ft	N·m	lb-ft
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N·m	lb-ft	N·m	lb-ft				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N·m	lb-ft	N·m	lb-ft	N·m	lb-ft								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N·m	lb-ft														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] Grade 2 applies for hex cap screws (not hex bolts) up to 6. in (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

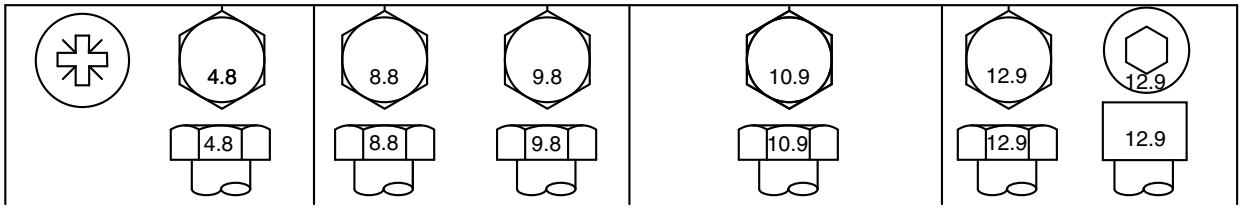
[b] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C zinc flake coating.

[c] "Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B zinc flake coating.

DX,TORQ1 -19-24MAR09-1/1

Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
Screw	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
Size	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in	N·m	lb-in
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N·m	lb-ft	N·m	lb-ft	N·m	lb-ft								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N·m	lb-ft														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] *"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C zinc flake coating.*

[b] *"Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B zinc flake coating.*

DX,TORQ2 -19-24MAR09-1/1

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10.2. Appendix B - Alternator user and maintenance manual

User guide and maintenance manual

LEROY SOMER

Alternator

43.2 & 44.2
SHUNT, AREP & PMG

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01/06/2011

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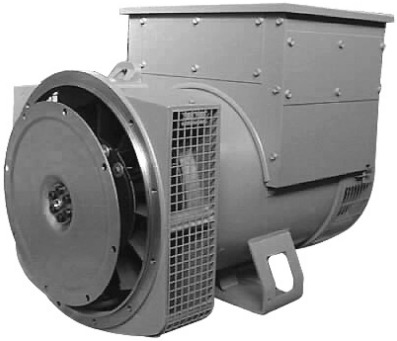
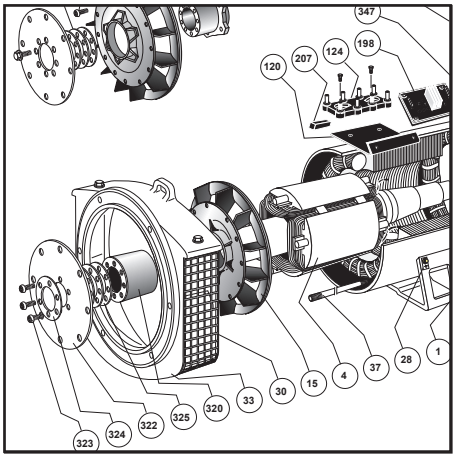
LEROY SOMER

3434 en - 2011.06 / j



This manual is to be given to the end user



LSA 43.2/44.2 - 4 POLES

ALTERNATORS

Installation and maintenance

LSA 43.2/44.2 - 4 POLES
ALTERNATORS

This manual concerns the alternator which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to the potential risk of accidents. It is vital that you understand and take notice of the different warning symbols used.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.

Warning symbol for general danger to personnel.

Warning symbol for electrical danger to personnel.

WARNING SYMBOLS

We wish to draw your attention to the following 2 safety measures which must be complied with:

a) During operation, do not allow anyone to stand in front of the air outlet guards, in case anything is ejected from them.

b) Do not allow children younger than 14 to go near the air outlet guards.

A set of self-adhesive stickers depicting the various warning symbols is included with this maintenance manual. They should be positioned as shown in the drawing below once the machine has been fully installed.

WARNING
The alternators must not be put into service until the machines in which they are to be incorporated have been declared compliant with Directives EC and plus any other directives that may be applicable.

Note: LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

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LSA 43.2/44.2 - 4 POLES
ALTERNATORS

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1 - RECEIPT

1.1 - Standards and safety measures

Our alternators comply with most international standards.
See the EC Declaration of Incorporation on the last page.

1.2 - Inspection

On receipt of your alternator, check that it has not suffered any damage in transit. If there are obvious signs of knocks, contact the transporter (you may be able to claim on their insurance) and after a visual check, turn the machine by hand to detect any malfunction.

1.3 - Identification

The alternator is identified by means of a nameplate fixed on the machine (see drawing).
Make sure that the nameplate on the machine conforms to your order.
The machine name is defined according to various criteria, for example :
LSA 43.2 M45 J6/4 -
- LSA : name used in the PARTNER range
  M : Marine
  C : Cogeneration
  T : Telecommunications
- 43.2 : machine type
- M45 : model
- J : excitation system
  (C : AREP / J : SHUNT or PMG)
- 6/4 : winding number / number of poles.

1.3.1 - Nameplate

So that you can identify your machine quickly and accurately, we suggest you write its specifications on the nameplate below.

1.4 - Storage

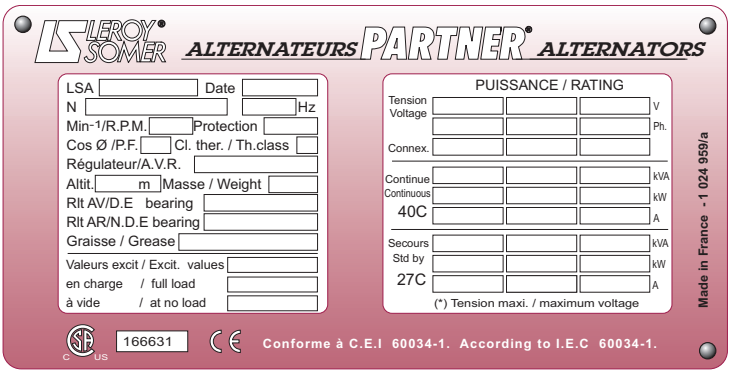
Prior to commissioning, machines should be stored :
- Away from humidity (< 90%); after a long period of storage, check the machine insulation (section 3.2.1). To prevent the bearings from becoming marked, do not store in an environment with significant vibration.

1.5 - Application

These alternators are mainly designed to produce electricity in the context of applications involving the use of generators.

1.6 - Contraindications to use

Use of the machine is restricted to operating conditions (environment, speed, voltage, power, etc) compatible with the characteristics indicated on the nameplate.



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2 - TECHNICAL CHARACTERISTICS

1.1 - Electrical characteristics

The LSA 43.2/44.2 alternator is a machine without sliprings or revolving armature brushes, wound as “2/3 pitch”, 12-wire, with class H insulation and a field excitation system available in either SHUNT, AREP or «PMG» version (see diagrams and AVR manuals).

2.1.1 - Electrical options

- Stator temperature detection sensors
- Space heater

Interference suppression conforms to standard EN 55011, group 1, class B (Europe).

2.2 - Mechanical characteristics

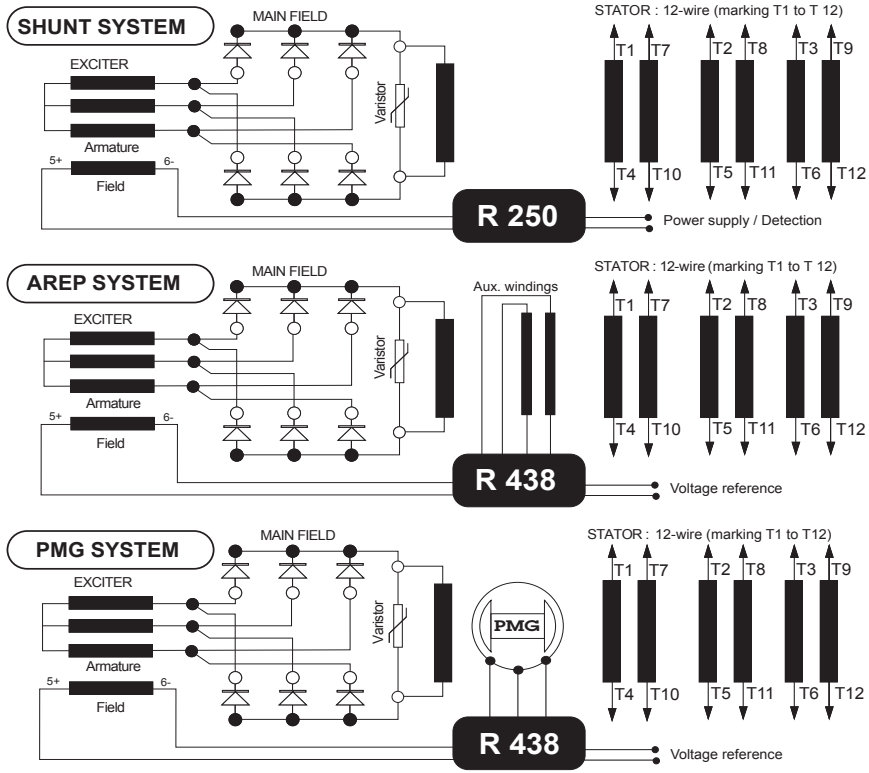
- Steel frame
- Cast iron end shields
- Protected ball bearings, greased for life
- Mounting arrangements:

IM 1201 (MD 35) foot and flange mounted, single-bearing with SAE coupling disc.
IM 1001 (B 34) double-bearing with SAE flange and standard cylindrical shaft extension.

- Drip-proof machine, self-cooled
- Degree of protection: IP 23

2.1.1 - Mechanical options

- Air inlet filter
- Regreasable ball bearings (only for LSA 44.2 and SHUNT or AREP version)
- IP 44 protection



3 - INSTALLATION

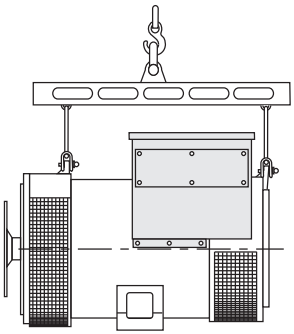
Personnel undertaking the various operations indicated in this section must wear personal protective equipment appropriate for mechanical and electrical hazards.

3.1 - Assembly

All mechanical handling operations must be undertaken using suitable equipment and the machine must be horizontal. Check how much the machine weighs (see 4.8.3.) before choosing the lifting tool.

3.1.1 - Handling

The generously-sized lifting rings are for handling the alternator alone. They must not be used to lift the genset. The choice of lifting hooks or handles should be determined by the shape of these rings. Choose a lifting system which respects the integrity and the environment of the alternators.



During this operation, do not allow anyone to stand under the load.

3.1.2 - Coupling

3.1.2.1 - Single-bearing alternator

Before coupling the machines, check that they are compatible by:
- undertaking a torsional analysis of the transmission,
- checking the dimensions of the flywheel and its housing, the flange, coupling discs and offset.

WARNING

When coupling the alternator to the prime mover, do not use the fan to turn the alternator or rotor.
The holes of the coupling discs should be aligned with the flywheel holes by cranking the engine.
Make sure the alternator is securely bedded in position during coupling.
Check that there is lateral play on the crankshaft.

3.1.2.2 - Double-bearing alternator

- Semi-flexible coupling

Careful alignment of the machines is recommended, checking that the lack of concentricity and parallelism of both parts of the coupling do not exceed 0.1 mm.
This alternator has been balanced with a 1/2 key.

3.1.3 - Location

The room where the alternator is placed must be ventilated to ensure that the ambient temperature cannot exceed the data on the nameplate.

3.2 - Checks prior to first use

3.2.1 - Electrical checks

Under no circumstances should an alternator, new or otherwise, be operated if the insulation is less than 1 megohm for the stator and 100,000 ohms for the other windings.

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There are 2 possible methods for restoring the above minimum values.
a) Dry out the machine for 24 hours in a drying oven at a temperature of 110 °C (without the regulator).
b) Blow hot air into the air intake, having made sure that the machine is rotating with the exciter field disconnected.

Note : Prolonged standstill: In order to avoid these problems, we recommend the use of space heaters, as well as turning over the machine from time to time. Space heaters are only really effective if they are working continuously while the machine is stopped.

WARNING

Ensure that the alternator has the degree of protection matching the defined environmental conditions.

3.2.2 - Mechanical checks

Before starting the machine for the first time, check that:
- all fixing bolts and screws are tight.
- the cooling air is drawn in freely.
- the protective grilles and housing are correctly in place.
- the standard direction of rotation is clockwise as seen from the shaft end (phase rotation in order 1 - 2 - 3).
For anti-clockwise rotation, swap 2 and 3.
- the winding connection corresponds to the site operating voltage (see section 3.3).

3.3 - Terminal connection diagrams

To modify the connection, change the position of the stator cables on the terminals. The winding code is specified on the nameplate.

3.3.1 - Terminal connection: 12 wire

The connection accessories are detailed in section 5.3.3.

Any intervention on the alternator terminals during reconnection or checks should be performed with the machine stopped.

Connection codes	L.L. voltage			Factory connection
A 3 phases L1(U) T1 T7 T4 T10 N T12 T5 T9 T2 T11 T6 T3 T8 L3(W) L2(V)	**Winding**	50 Hz	60 Hz	T11 T5 T6 T12 T10 T4 N T9 L3(W) T3 T8 L2(V) T2 T7 L1(U) T1 NDE
	6	190 - 208	190 - 240	
	7	220 - 230	-	
	8	-	190 - 208	
	R 250 voltage sensing: 0 => (T8) / 110 V => (T11) R 438 voltage sensing: 0 => (T3) / 110 V => (T2)			
D 3 phases L1(U) T1 T4 T7 T10 N T12 T9 T11 T5 T3 T6 T8 T2 L3(W) L2(V)	**Winding**	50 Hz	60 Hz	T11 T12 T10 N T9 T6 T3 L3(W) T8 T5 T2 L2(V) T7 T4 T1 L1(U) NDE
	6	380 - 415	380 - 480	
	7	440 - 460	-	
	8	-	380 - 416	
	R 250 voltage sensing: 0 => (T8) / 110 V => (T11) R 438 voltage sensing: 0 => (T3) / 380 V => (T2)			

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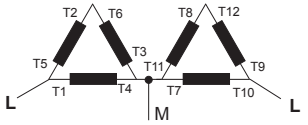
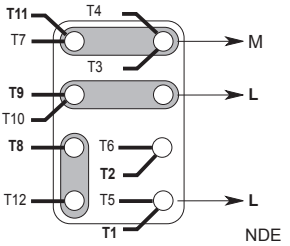
FF — 1 phase



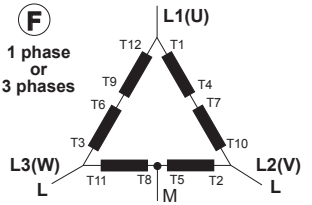
LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T1) / 110 V => (T4)
R 438 voltage sensing:
0 => (T10) / 220 V => (T1)



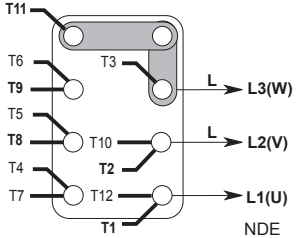
F — 1 phase or 3 phases



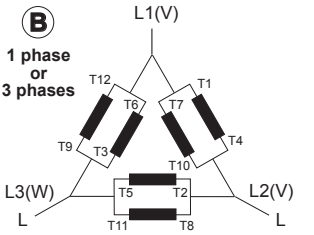
LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 220 V => (T2)

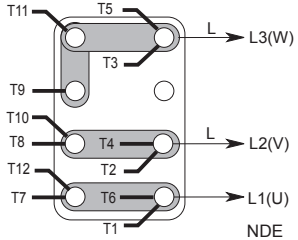


B — 1 phase or 3 phases



Winding	50 Hz	60 Hz
6	110 - 120	120
7	120 - 130	-
8	-	110 - 120

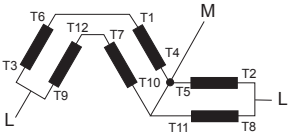
R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 110 V => (T2)



⚠ FOR LSA 44.2, THE COUPLING **B** IS NOT POSSIBLE

G — 1 phase

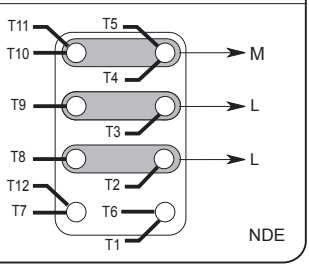
Connection not recommended



LM voltage = 1/2 LL voltage

Winding	50 Hz	60 Hz
6	220 - 240	220 - 240
7	250 - 260	-
8	200	220 - 240

R 250 voltage sensing:
0 => (T8) / 110 V => (T11)
R 438 voltage sensing:
0 => (T3) / 220 V => (T2)



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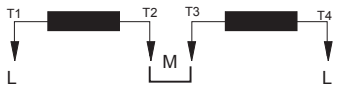
SINGLE-PHASE 4-WIRE - type M or M1 DEDICATED WINDING

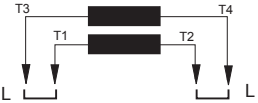
SERIAL CONNECTION



Voltage 50/60Hz			Output		
L - L	L - M	Link	L	L	M
220 230 240	110 115 120	T2 - T3	T1	T4	T2 - T3

R 251 voltage sensing: 0 => (T1) / 110 V => (T2)

PARALLEL CONNECTION (Not possible with LSA 44.2)

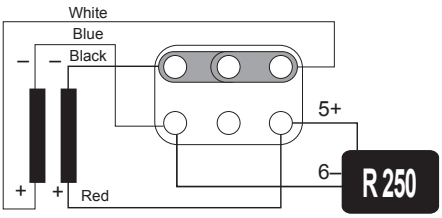


Voltage 50/60Hz			Output		
L - L	L - M	Link	L	L	M
110 115 120	- - -	T1 - T3 T2 - T4	T1-T3	T2 - T4	-

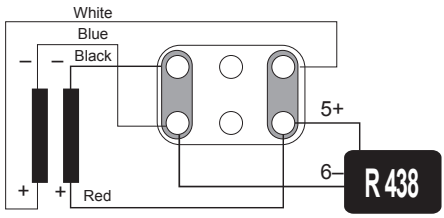
R 251 voltage sensing: 0 => (T1) / 110 V => (T2)

3.3.2 - Exciter field connection

Series connection (shunt excitation)



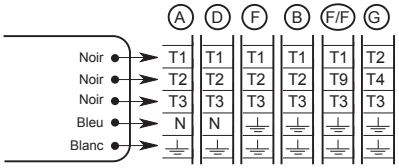
Parallel connection (AREP or PMG excitation)



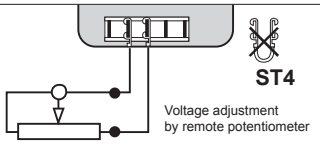
Single-phase dedicated SHUNT version: R 251 AVR (2-wire output without terminal block)

3.3.3 - Option connection diagram

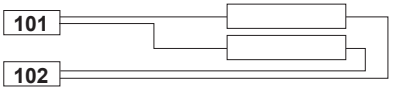
R 791 T interference suppression kit (standard for CE marking)



Voltage potentiometer

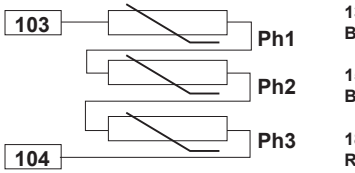


Anti condensation heater



LSA 43.2, 44.2

Thermistor (PTC) temperature



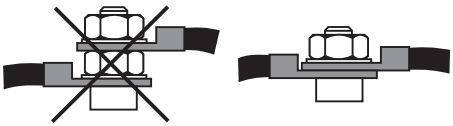
130°C Blue wire

150°C Black wire

180°C Red/white wire

3.3.4 - Connection checks

Electrical installations must comply with the current legislation in force in the country of use.
Check that:
- The residual circuit-breaker conforms to legislation on protection of personnel, in force in the country of use, and has been correctly installed on the alternator power output as close as possible to the alternator. (In this case, disconnect the wire of the interference suppression module linking the neutral).
- Any protection devices in place have not been tripped.
- If there is an external AVR, the connections between the alternator and the cabinet are made in accordance with the connection diagram.
- There is no short-circuit phase-phase or phase-neutral between the alternator output terminals and the generator set control cabinet (part of the circuit not protected by circuitbreakers or relays in the cabinet).
- The machine should be connected with the busbar separating the terminals as shown in the terminal connection diagram.



3.4 - Commissioning

The machine can only be started up and used if the installation is in accordance with the regulations and instructions defined in this manual.
The machine is tested and set up at the factory. When first used with no load, make sure that the drive speed is correct and stable (see the nameplate). With the regreasable bearing option, we recommend greasing the bearings at the time of commissioning (see 4.2.2).
On application of the load, the machine should achieve its rated speed and voltage; however, in the event of abnormal operation, the machine setting can be altered (follow the adjustment procedure in section 3.5). If the machine still operates incorrectly, the cause of the malfunction must be located (see section 4.4).

3.5 - Setting up

The various adjustments during tests must be made by a qualified engineer.
Ensure that the drive speed specified on the nameplate is reached before commencing adjustment.
After operational testing, replace all access panels or covers.
The AVR is used to make any adjustments to the machine.

4 - SERVICING - MAINTENANCE

4.1 - Safety measures

Servicing or troubleshooting must be carried out strictly in accordance with instructions so as to avoid the risk of accidents and to maintain the machine in its original state.

All such operations performed on the alternator should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components, who must wear personal protective equipment appropriate for mechanical and electrical hazards.

Before any intervention on the machine, ensure that it cannot be started by a manual or automatic system and that you have understood the operating principles of the system.

4.2 - Routine maintenance

4.2.1 - Checks after start-up

After approximately 20 hours of operation, check that all fixing screws on the machine are still tight, plus the general state of the machine and the various electrical connections in the installation.

4.2.2 - Bearings

The bearings are permanently greased and they have a life of (20,000 hrs) or 3 years.
As an option, they are regreasable for the LSA 44.2. It is advisable to lubricate the alternator during operation and when it is first commissioned. The lubrication characteristics are given in the table below.

NDE/DE bearing	6315 C3	6309 C3
Quantity of grease	30 gr or cm^3	15 gr or cm^3
Lubrication interval	6000 h	10 000 h

Lubrication intervals are given for grease type: LITHIUM - standard - NLGI 3.
In the factory, the grease used for lubrication is: ESSO - Unirex N3.
Before using another grease, check for compatibility with the original one. Monitor the temperature rise in the bearings (see section 4.4).

4.2.3 - Electrical servicing

Commercially-available volatile degreasing agents can be used.

WARNING

Do not use: trichlorethylene, perchlorethylene, trichloroethane or any alkaline products.

These operations must be performed at a cleaning station, equipped with a vacuum system that collects and flushes out the products used.
The insulating components and the impregnation system are not at risk of damage from solvents. Avoid letting the cleaning product run into the slots.
Apply the product with a brush, sponging frequently to avoid accumulation in the housing. Dry the winding with a dry cloth. Let any traces evaporate before reassembling the machine.

4.2.4 - Mechanical servicing

WARNING

Cleaning the machine using water or a highpressure washer is strictly prohibited. Any problems arising from such treatment are not covered by our warranty.
Degreasing: Use a brush and detergent (suitable for paintwork).
Dusting: Use an air gun.
If the machine is fitted with air inlet and outlet filters, the maintenance personnel should clean them routinely at regular intervals. In the case of dry dust, the filter can be cleaned using compressed air and/or replaced if it is clogged.
After cleaning the alternator, it is essential to check the winding insulation (see sections 3.2 and 4.8).

4.3 - Fault detection

If, when commissioned, the alternator does not work normally, the source of the malfunction must be identified (see sections 4.4 and 4.5).

4.4 - Mechanical defects

Fault		Action
Bearing	Excessive temperature rise in one or both bearings (bearing temperature more than 80 °C) with or without abnormal bearing noise	- If the bearing has turned blue or if the grease has turned black, change the bearing - Bearing not fully locked (abnormal play in the bearing cage) - Check the end shield alignment (flange not properly fitted)
Abnormal temperature	Excessive temperature rise in the alternator housing (more than 40° C above the ambient temperature)	- Air flow (intake-outlet) partially clogged or hot air is being recycled from the alternator or engine - Alternator operating at too high a voltage (> 105% of Un on load) - Alternator overloaded
Vibration	Excessive vibration	- Misalignment (coupling) - Defective mounting or play in coupling - Rotor balancing fault (Engine - Alternator)
	Excessive vibration and humming noise coming from the machine	- Phase imbalance - Stator short-circuit
Abnormal noise	Alternator damaged by a significant impact, followed by humming and vibration	- System short-circuit - Mis-paralleling Possible consequences: - Broken or damaged coupling - Broken or bent shaft extension - Shifting and short-circuit of revolving field winding - Fan fractured or coming loose on shaft - Irreparable damage to rotating diodes, AVR, surge suppressor

4.5 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 volts to terminals E- and E+, respecting the polarity, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed	- Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings open circuit (check winding) - Revolving field coil open circuit (check the resistance)
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Revolving field coil short-circuited - Check the resistance
		Speed too low	Increase the drive speed (do not touch the AVR voltage pot. (P2) before running at the correct speed)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	Faulty AVR
Voltage oscillations	Adjust the AVR stability potentiometer	If no effect: try normal or fast stability modes (ST2)	- Check the speed: possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or AVR LAM set too high)
Voltage correct at no load and too low when on load	Run at no load and check the voltage between E+ and E- on the AVR	Voltage between E+ and E- (DC) SHUNT < 20V - AREP / PMG < 10V	- Check the speed (or AVR LAM set too high)
		Voltage between E+ and E- SHUNT > 30V - AREP / PMG > 15V	- Faulty rotating diodes - Short-circuit in the revolving field coil. Check the resistance. - Faulty exciter armature. Check the resistance.
Voltage disappears during operation	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Revolving field coil open circuit or short-circuited

4.5.1 - Checking the winding

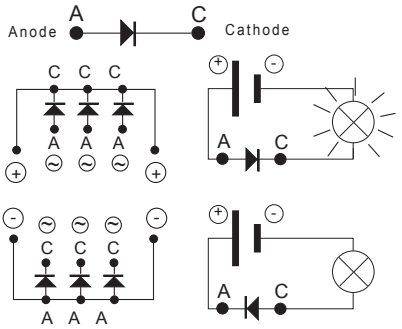
You can check the winding insulation by performing a high voltage test. In this case, you must disconnect all AVR wires.

WARNING

Damage caused to the AVR in such conditions is not covered by our warranty.

4.5.2 - Checking the diode bridge

A diode in good working order should allow the current to flow only in the anode-to-cathode direction.

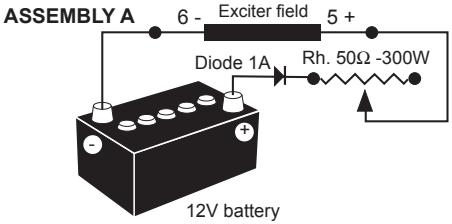


4.5.3 - Checking the windings and rotating diodes using separate excitation

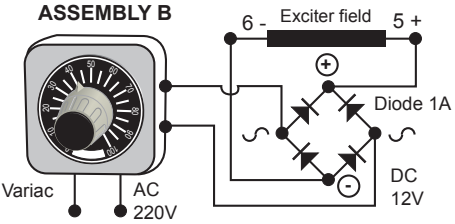
During this procedure, make sure that the alternator is disconnected from any external load and inspect the terminal box to check that the connections are fully tightened.

1) Stop the unit, disconnect and isolate the AVR wires.
2) There are two ways of creating an assembly with separate excitation.

Assembly A: Connect a 12 V battery in series with a rheostat of approximately 50 ohms - 300 W and a diode on both exciter field wires (5+) and (6-).



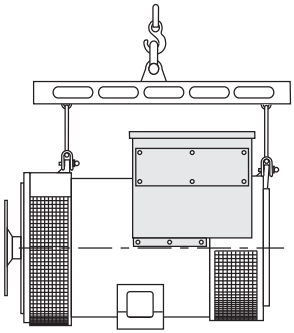
Assembly B: Connect a "Variac" variable power supply and a diode bridge on both exciter field wires (5+) and (6-).
Both these systems should have characteristics which are compatible with the field excitation power of the machine (see the nameplate).
3) Run the unit at its rated speed.
4) Gradually increase the exciter field current by adjusting the rheostat or the variac and measure the output voltages on L1 - L2 - L3, checking the excitation voltage and current at no load (see the machine nameplate or ask for the factory test report). When the output voltage is at its rated value and balanced within 1% for the rated excitation level, the machine is in good working order. The fault therefore comes from the AVR or its associated wiring (ie. sensing, auxiliary windings).



4.6 - Dismantling, reassembly (see sections 5.4.1. & 5.4.2.)

WARNING

During the warranty period, this operation should only be carried out in an LEROY-SOMER approved workshop or in our factory, otherwise the warranty may be invalidated.
Whilst being handled, the machine should remain horizontal (rotor not locked in position). Check how much the machine weighs (see 4.8.7) before choosing the lifting method.



4.6.1 - Tools required

To fully dismantle the machine, we recommend using the tools listed below:
- 1 ratchet spanner + extension
- 1 torque wrench
- 1 set of flat spanners: 7, 8, 10, 12 mm
- 1 socket set: 8, 10, 13, 16, 18, 21, 22, 24 mm
- 1 size: 5 Allen key (eg. Facom: ET5), 6 Allen key (ET6), 10 Allen key (ET10), 14 Allen key (ET14)
- 1 T20 and T30 TORX bit
- 1 puller (U35) / (U32/350).

4.6.2 -Screw tightening torque

See section 5.4.

4.6.3 - Access to diodes

- Remove the air intake grille [51]
- Remove the surge suppressor [347]
- Disconnect the 6 diodes using an ohm-meter or a battery lamp (see section 4.5.2)
- Replace the bridges, respecting the polarity (see section 4.5.1)
- Replace the surge suppressor [347]
- Refit the air intake grille [51]
- Replace the terminal box lid [48]

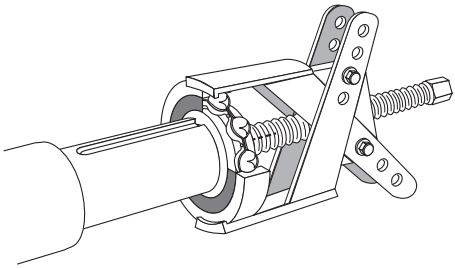
4.6.4 - Access to connections and the regulation system

The terminals are accessed directly by removing the terminal box lid [48].
To access the AVR adjustment potentiometers, the side plate [367] should be removed.

4.6.5 - Replacing the NDE bearing

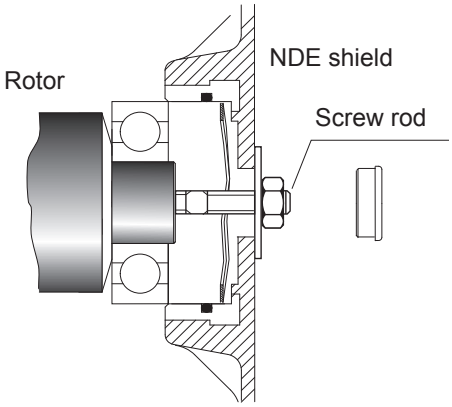
4.6.5.1 - Dismantling

- Remove the terminal box lid [48]
- Remove the air intake grille [51]
- Unscrew the fixing clamps on the power output cables, remove the connector from the exciter and the R 791 module.
- Remove the 4 nuts on the tie rods
- Remove the NDE shield [36] using a puller: eg. U.32 - 350 (FACOM)
- Remove the ball bearing [70] using a screw puller.



4.6.5.2 - Reassembly

- Heat the inner slipring of a new bearing by induction or in a drying oven at 80 °C (do not use an oil-bath) and fit it to the machine.
- Place the preloading wavy washer [79] in the shield and fit a new O ring seal [349]. Refit the NDE shield and pass the bundle of wires between the top bars of the shield.
- Refit the fixing clamps on the cables, the R 791 module and the exciter connector.
- Refit the air intake grille [51].
- Replace the terminal box lid [48].



WARNING

When dismantling the shields, you will need to change the antifriction bearings, the "O" ring seal, the preloading (wavy) washer and adhesive paste.

4.6.6 - Replacing the DE bearing

4.6.6.1 - Dismantling

- Uncouple the alternator from the prime mover.
- Remove the 8 assembly screws.
- Remove the DE shield [30].
- Remove the NDE shield (see section 4.6.5.1)
- Remove both ball bearings [60] and [70] using a puller with a central screw.

4.6.6.2 - Reassembly

- Heat the new bearings by induction or in a drying oven at 80°C (do not use an oil-bath) and fit them to the machine.
- Check that both the preloading wavy washer [79] and the new O ring seal [349] have been fitted on the NDE shield [36].

Refit the NDE shield and pass the bundle of wires between the top bars of the shield.

- Refit the DE shield [30] and tighten the 4 fixing screws.
- Check that the machine assembly is correctly mounted and that all screws are tightened.

4.6.7 - Accessing the main field and stator

4.6.7.1 - Dismantling

Follow the procedure for dismantling the bearings (see sections 4.6.5.1 and 4.6.6.1)

- Remove the coupling disc (single-bearing alternator) or the DE shield (two-bearing alternator) and insert a tube of the corresponding diameter on the shaft end.
- Rest the rotor on one of its poles, then slide it out. Use the tube as a lever arm to assist dismantling.
- After extraction of the rotor, be careful not to damage the fan. If the fan is dismantled, it is essential that it is replaced for the 43.2.

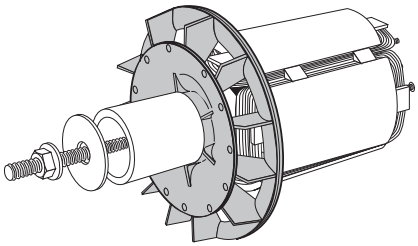
NOTE: If intervention is required on the main field (rewinding, replacement of components), the rotor assembly must be rebalanced.

4.6.7.2 - Reassembling the main field

- Follow the dismantling procedure in reverse order.

Take care not to knock the windings when refitting the rotor in the stator.

- If the fan is being replaced on the 43.2, assemble the parts as shown in the following diagram. Fit a tube and a threaded screw. On the 44.2 the fan is fixed by screws on the hub.



Follow the procedure for reassembling the bearings (see sections 4.6.5.2 and 4.6.6.2).

LSA 43.2/44.2 - 4 POLES
ALTERNATORS

4.7 - Installation and maintenance of the PMG

For the LSA 43.2 and LSA 44.2, the PMG reference is PMG 1.
See the PMG maintenance manual, ref: 4211.

WARNING

Mounting is impossible with the «regreasable bearings» option with the LSA 44.2.

4.8 - Table of characteristics

Table of average values:
Alternator - 2 and 4 poles - 50 Hz/60 Hz - Winding n° 6 and M or M1 connected in dedicated single-phase. (400 V for the excitation values).
The voltage and current values are given for no-load operation and operation at rated load with separate field excitation. All values are given at ± 10% (for exact values, consult the test report) and are subject to change without prior warning. For 60 Hz machines, the resistance values are the same and the excitation current «i exc» is approximately 5 to 10% weaker.

4.8.1 - 3-phase LSA 43.2 4 P, SHUNT excitation

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Field	Armature
S1	0.155	1.35	18.4	0.23
S15	0.155	1.35	18.4	0.23
S25	0.155	1.35	18.4	0.23
S35	0.128	1.41	18.4	0.23
M45	0.105	1.57	18.4	0.23
L65	0.083	1.76	18.4	0.23
L8	0.063	1.96	18.4	0.23

Field excitation current i exc (A) - 400 V - 50 Hz
«i exc»: excitation current of the exciter field

LSA 43.2	no load	at load
S1	0.5	1.3
S15	0.5	1.5
S25	0.5	1.6
S35	0.5	1.8
M45	0.4	1.6
L65	0.4	1.6
L8	0.4	1.6

4.8.2 - 3-phase LSA 43.2 4 P, AREP excitation

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Wind. X1,X2	Wind. Z1,Z2	Field	Armat.
S1	0,155	1,35	0,32	0,52	4,6	0,23
S15	0,155	1,35	0,32	0,52	4,6	0,23
S25	0,155	1,35	0,32	0,52	4,6	0,23
S35	0,128	1,41	0,29	0,5	4,6	0,23
M45	0,105	1,57	0,26	0,51	4,6	0,23
L65	0,083	1,76	0,26	0,44	4,6	0,23
L8	0,063	1,96	0,21	0,4	4,6	0,23

Field excitation current i exc (A) - 400 V - 50 Hz
«i exc»: excitation current of the exciter field

LSA 43.2	no load	at load
S1	1	2,6
S15	1	3
S25	1	3,2
S35	1	3,6
M45	0,8	3,2
L65	0,8	3,2
L8	0,8	3,2

4.8.3 - Dedicated single-phase LSA 43.2: 4-pole, SHUNT excitation (60 Hz only)

Resistances at 20 °C (Ω)

LSA 43.2	Stator L/N	Rotor	Field	Armature
S1	0,058	1,35	13,9	0,23
S25	0,058	1,35	13,9	0,23
S35	0,046	1,41	13,9	0,23
M45	0,037	1,57	13,9	0,23
L65	0,027	1,76	13,9	0,23
L8	0,019	1,96	13,9	0,23

Field excitation current i exc (A) - 240 V - 60 Hz
«i exc»: excitation current of the exciter field

LSA 43.2	no load	at load
S1	0,59	1,44
S25	0,59	1,68
S35	0,66	1,65
M45	0,61	1,48
L65	0,62	1,48
L8	0,74	1,46

LSA 43.2/44.2 - 4 POLES
ALTERNATORS

4.8.4 - 3-phase LSA 44.2: 4-pole, SHUNT excitation

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Field	Armature
VS3	0.046	2.51	18.4	0.5
VS45	0.046	2.51	18.4	0.5
S7	0.036	2.91	18.4	0.5
S75	0.036	2.91	18.4	0.5
M95	0.024	3.32	18.4	0.5
L12	0.019	3.66	18.4	0.5

Field excitation current i exc (A) - 400 V - 50 Hz
«i exc»: excitation current of the exciter field

LSA 44.2	no load	at load
VS3	0.5	1.8
VS45	0.5	2.1
S7	0.5	1.9
S75	0.5	2.1
M95	0.6	2
L12	0.5	1.9

4.8.5 - 3-phase LSA 44.2: 4-pole, AREP excitation

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Wind. X1,X2	Wind. Z1,Z2	Field	Armat.
VS3	0.046	2.51	0.3	0.5	4.6	0.5
VS45	0.046	2.51	0.3	0.5	4.6	0.5
S7	0.036	2.91	0.21	0.32	4.6	0.5
S75	0.033	2.91	0.21	0.32	4.6	0.5
M95	0.024	3.32	0.17	0.28	4.6	0.5
L12	0.019	3.66	0.16	0.21	4.6	0.5

Field excitation current i exc (A) - 400 V - 50 Hz
«i exc»: excitation current of the exciter field

LSA 44.2	no load	at load
VS3	1	3.6
VS45	1	4.2
S7	1	3.8
S75	1	4.2
M95	1.2	4
L12	1	3.8

4.8.6 - Dedicated single-phase LSA 44.2: 4-pole, SHUNT excitation (60 Hz only)

Resistances at 20 °C (Ω)

LSA 44.2	Stator L/N	Rotor	Field	Armature
VS3	0.0194	2.51	18.4	0.5
VS45	0.0194	2.51	18.4	0.5
S7	0.0140	2.91	18.4	0.5
M95	0.0088	3.32	18.4	0.5

Field excitation current i exc (A) - 240 V - 60 Hz
«i exc»: excitation current of the exciter field

LSA 44.2	no load	at load
VS3	0.44	1.18
VS45	0.44	1.25
S7	0.43	1.2
M95	0.55	1.28

4.8.7 - Table of weights

(values given for information only)

LSA 43.2	Total weight (kg)	Rotor (kg)
S1	220	76
S15	220	76
S25	220	76
S35	240	80
M45	270	90
L65	290	102
L8	330	120

LSA 44.2	Total weight (kg)	Rotor (kg)
VS3	405	140
VS45	405	140
S7	460	165
S75	460	165
M95	515	185
L12	570	210

After operational testing, it is essential to replace all access panels or covers.

5 - SPARE PARTS

5.1 - First maintenance parts

Emergency repair kits are available as an option.
They contain the following items:

Emergency kit SHUNT	ALT 432 KS 001
AVR R 250	-
Diode bridge assembly	-
Surge suppressor	-

Emergency kit AREP	ALT 432 KS 002
AVR R 450	-
Diode bridge assembly	-
Surge suppressor	-

Single-bearing kit	ALT 432 KB 002
Non drive end bearing	-
«O» ring	-
Preloading (wavy) washer	-

Double-bearing kit	ALT 432 KB 001
Non drive end bearing	-
Drive end bearing	-
«O» ring	-
Preloading (wavy) washer	-

Single-bearing kit	ALT 442 KB 002
Non drive end bearing	-
«O» ring	-
Preloading (wavy) washer	-

Double-bearing kit	ALT 442 KB 001
Non drive end bearing	-
Drive end bearing	-
«O» ring	-
Preloading (wavy) washer	-

5.2 - Technical support service

Our technical support service will be pleased to provide any additional information you may require.

When ordering spare parts, you should indicate the complete machine type, its serial number and the information given on the nameplate.

Address your enquiry to your usual contact.

Part numbers should be identified from the exploded views and their description from the parts list.

Our extensive network of service centres can dispatch the necessary parts without delay.

To ensure correct operation and the safety of our machines, we recommend the use of original manufacturer spare parts.

In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

5.3 - Accessories

5.3.1 - Space heater for use when stopped

The space heater must run as soon as the alternator stops. It is installed at the rear of the machine. Its standard power is 250W with 220V or 250W with 110V on request.

Warning: the power supply is present when the machine has stopped.

5.3.2 - Temperature sensors with thermistors (PTC)

These are thermistor triplets with a positive temperature coefficient installed in the stator winding (1 per phase). There can be a maximum of 2 triplets in the winding (at 2 levels: warning and trip) and 1 or 2 thermistors in the shields.
These sensors must be linked to adapted sensing relays (supplied optionally).
Cold resistance of cold thermistor sensors: 100 to 250 Ω per sensor.

5.3.3 - Connection accessories

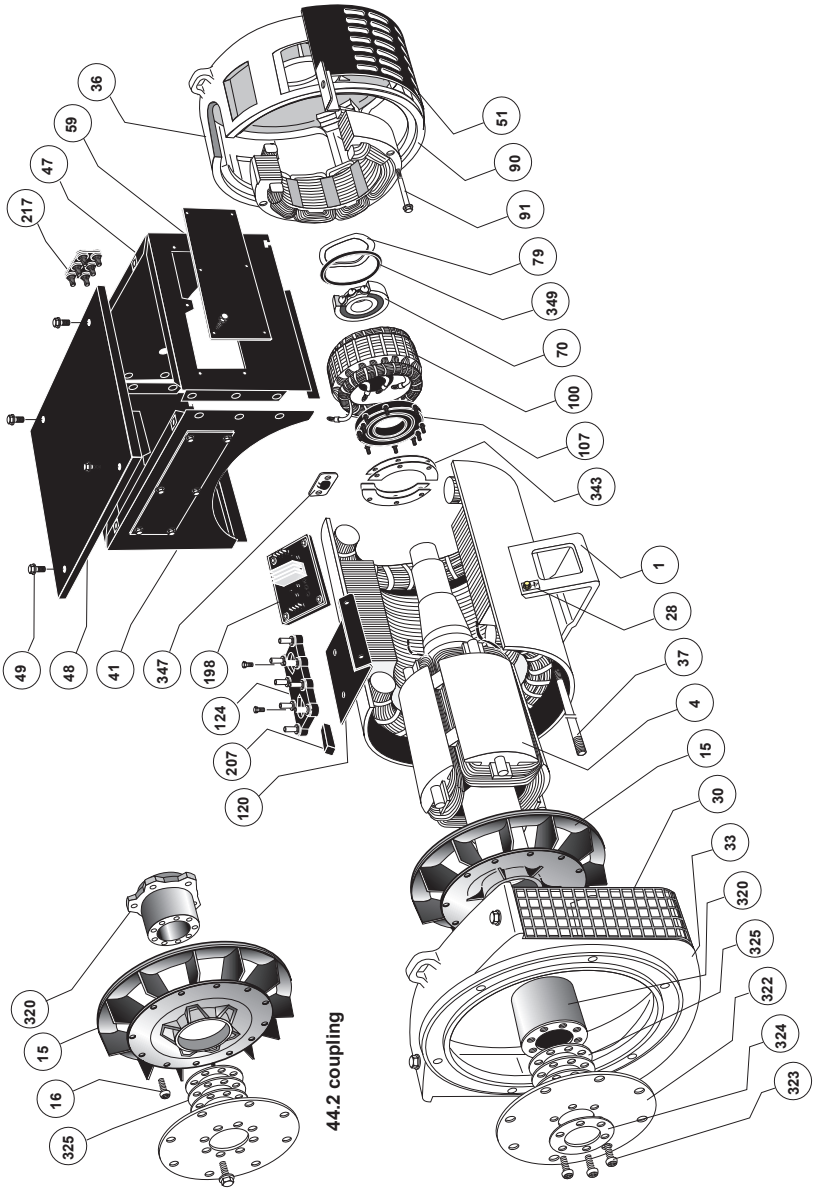
- 12-wire machines : coupling (F)
  3 flexible SHUNTS

After operational testing, it is essential to replace all access panels or covers.

LSA 43.2/44.2 - 4 POLES
ALTERNATORS

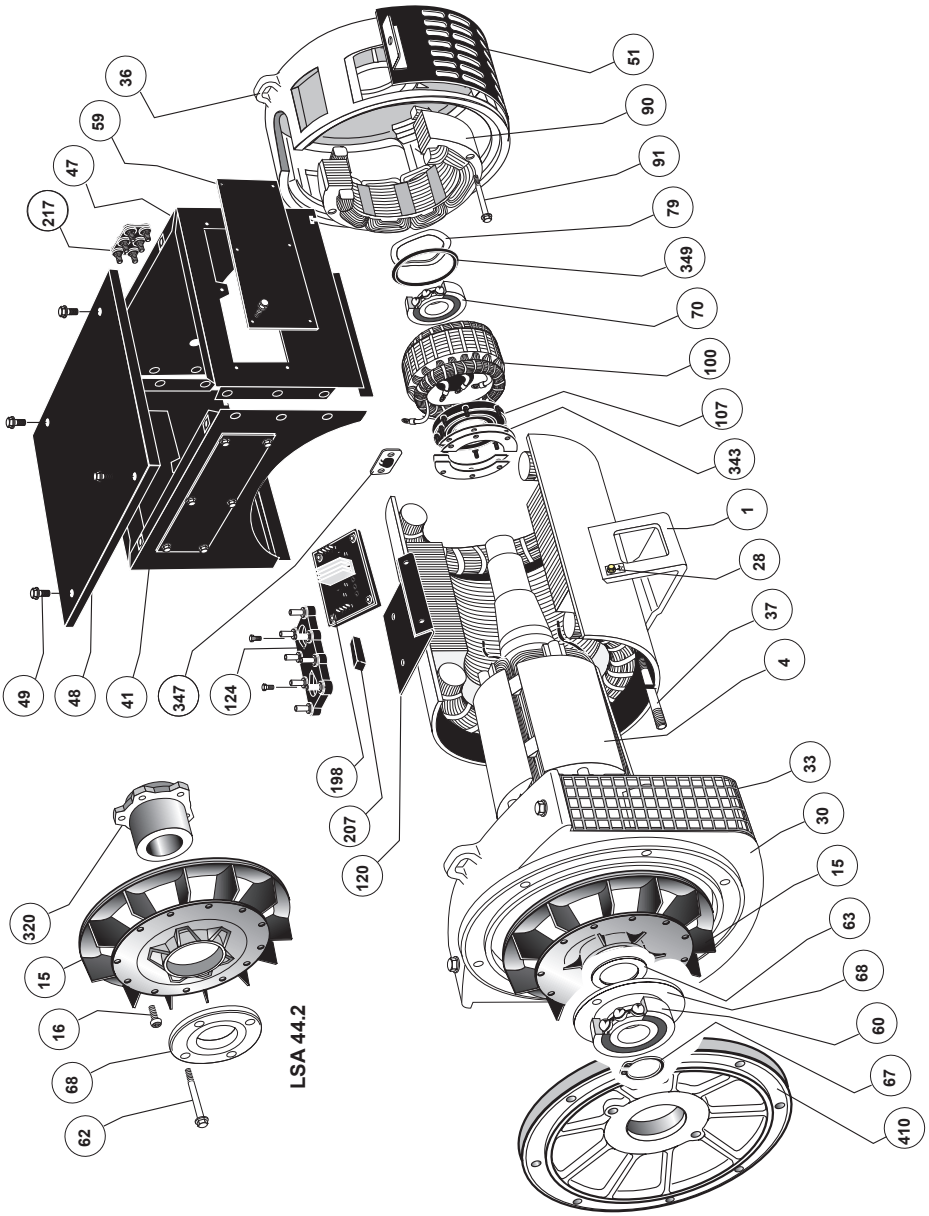
5.4 - Exploded view, parts list and tightening torque

5.4.1 - LSA 43.2 / 44.2 single-bearing



LSA 43.2/44.2 - 4 POLES
ALTERNATORS

5.4.2 - LSA 43.2 / 44.2 double-bearing



LSA 43.2/44.2 - 4 POLES
ALTERNATORS

Ref.	Qty	Description	Screw Ø	Torque N.m	Ref.	Qty	Description	Screw Ø	Torque N.m
1	1	Stator assembly	-	-	70	1	NDE bearing	-	-
4	1	Rotor assembly	-	-	79	1	Preloading wavy washer	-	-
15	1	Fan	M6	5	90	1	Exciter field	-	-
16	6	Fixing screws (44.2 only)	-	-	91	4	Exciter field fixing screw	M6	10
28	1	Earth terminal	M8	26	100	1	Exciter armature	-	-
30	1	DE shield	-	-	107	1	Diode crescent support	-	-
33	1	Air outlet grille	M6	5	120	1	Terminal block support (AREP)	-	-
36	1	Shield on exciter end	-	-	124	1	Terminal block	M10	20
37	4	Tie rod 43.2 Tie rod 44.2	M12 M14	57 90	198	1	Voltage regulator (AVR)	-	-
41	1	Cover front panel	-	-	207	1	AVR damper seal	-	-
47	1	Cover rear panel	-	-	217	1	Terminal block	-	-
48	1	Cover top panel	-	-	320	1	Hub (43.2 L7 & 44.2)	-	-
49	34	Fixing screws	M6	5	322	1	Coupling disc	-	-
51	1	Air intake grille	-	-	323	-	Fixing screws 43.2 Fixing screws 44.2	M12 M16	110 250
59	3	Inspection door	-	-	324	1	Clamping washer (43.2 S1 to L6)	-	-
60	1	DE bearing	-	-	325	-	Spacer shim (43.2 L7 & 44.2 only)	-	-
62	2/4	Bearing retainer fixing screw	-	-	343	1	Diode bridge assembly	M6	5
63	1	Cable gland washer (43.2 only)	-	-	347	1	Surge suppressor	-	-
67	1	Circlips	-	-	349	1	«O» ring	-	-
68	1	Inner bearing retainer	-	-	410	1	End shield	-	-

Electric Power Generation Division

Declaration of CE compliance and incorporation

This Declaration applies to the generators designed to be incorporated into machines complying with the Machinery Directive Nr 2006/42/CE dated 17 May 2006.

MOTEURS LEROY-SOMER
Boulevard Marcellin Leroy
16015 ANGOULEME
France

MLS HOLICE STLO.SRO
SLADKOVSKEHO 43
772 04 OLOMOUC
Czech Republic

MOTEURS LEROY-SOMER
1, rue de la Burelle
Boite Postale 1517
45800 St Jean de Braye
France

Declares hereby that the electric generators of the types LSA 36 – 37– 40 – 42.2 – 43.2 – 44.2 – 46.2 – 47.2 – 49.1 – 50.2 – 51.2, as well as their derivatives, manufactured by Leroy Somer or on Leroy Somer's behalf, comply with the following International Standards and Directive :

- EN and IEC 60034 -1 and 60034 -5
- ISO 8528 – 3 " Reciprocating internal combustion engine driven alternating current generating sets. Part 3. Alternating current generators for generating sets "
- Low Voltage Directive Nr 2006/95/CE dated 12 December 2006.

Furthermore, these generators, designed in compliance with the Machine Directive Nr 2006/42, are therefore able to be incorporated into Electrical Gen-Sets complying with the following International Directives :

- Machinery Directive Nr 2006/42/CE dated 17 May 2006
- EMC Directive Nr 2004/108/CE dated 15 December 2004, as intrinsic levels of emissions and immunity are concerned

WARNING :

The here above mentioned generators should not be commissioned until the corresponding Gen-Sets have been declared in compliance with the Directives Nr 2006/42/CE et 2004/108/CE, as well as with the other relevant Directives.

Leroy Somer undertakes to transmit, in response to a reasoned request by the national authorities, relevant information on the generator.

Technical Managers
P Betge – J.Begué

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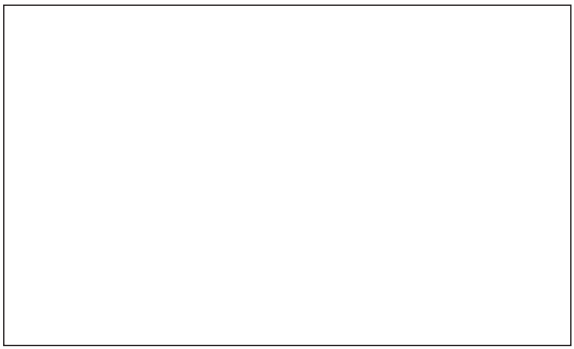
LSA 43.2/44.2 - 4 POLES
ALTERNATORS

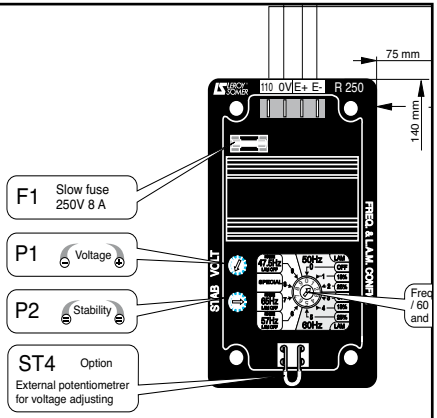


www.leroy-somer.com

LEROY SOMER

4067 en - 2009.05 / b

This manual is to be given to the end user



R250

A.V.R.

Installation and maintenance

247/290

R250
A.V.R.

This manual concerns the alternator A.V.R. which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual. By following certain important points during installation, use and servicing of your A.V.R., you can look forward to many years of trouble-free operation.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.

Warning symbol for general danger to personnel.

Warning symbol for electrical danger to personnel.

Note : LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments.
The information contained in this document may therefore be changed without notice.

R250
A.V.R.

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Any maintenance or breakdown operations on the A.V.R. are to be done by personnel trained on commisioning, servicing and maintenance for the electrical and mechanical elements.

The R250 is an IP00 product. It must be installed inside a unit so that this unit's cover can provide IP20 minimum total protection (it must only be installed on LS alternators in the appropriate location so that when viewed externally, it has a higher degree of protection than IP20).

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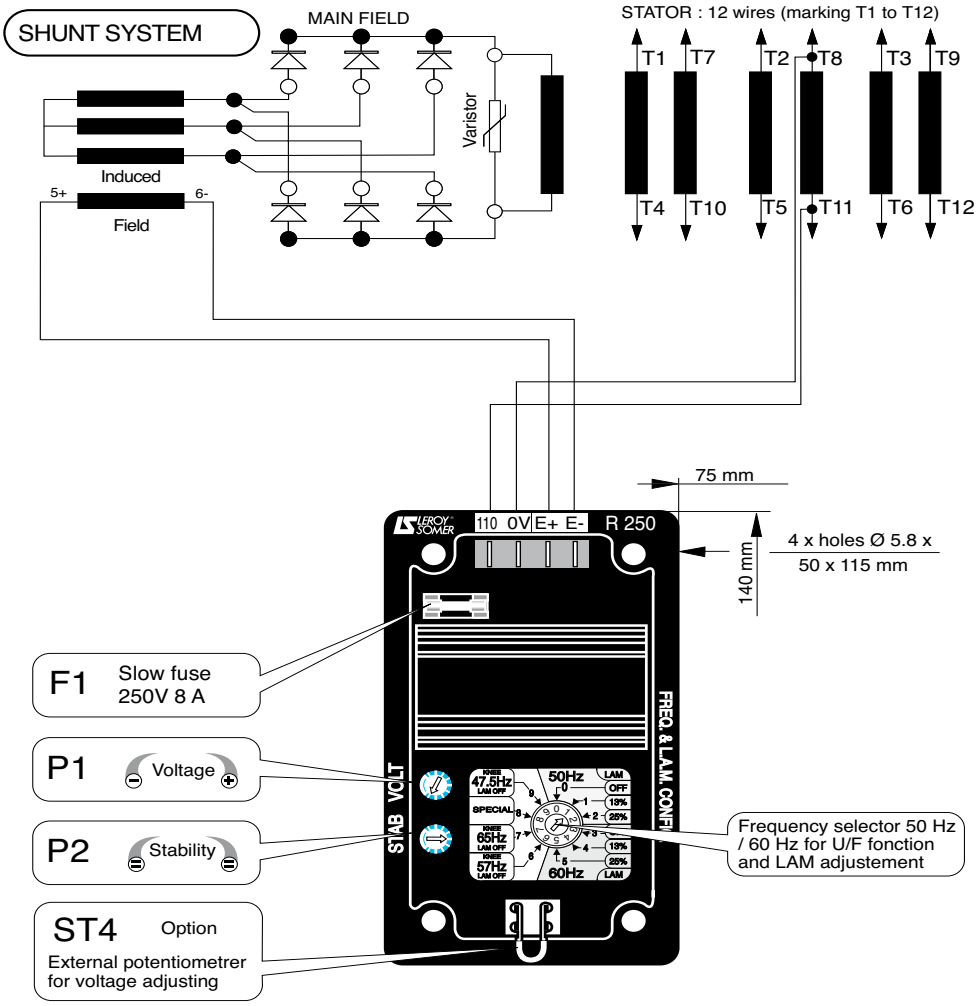
R250
A.V.R.

1 - SUPPLY

1.1 - SHUNT excitation system

The SHUNT excitation alternator is auto-excited with a **R 250** voltage regulator.

The regulator controls the excitation current according to the alternator's output voltage. With a very simple conception, the SHUNT excitation alternator does not have a short circuit capacity.



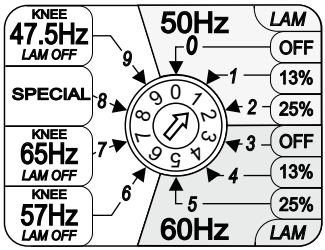
2 - R250 A.V.R.

2.1 - Characteristics

- Storage: -55°C; +85°C
- Operation: -40°C; +70°C
- Voltage regulation: around ± 0,5 %.
- Supply range/voltage detection 85 to 139 V (50/60Hz).
- Rapid response time (500 ms) for a transient voltage variation amplitude of ± 20 %.
- Voltage setting **P1**.
- Stability setting **P2**.
- Power supply protected by 8 A fuse, replacement product: Ferraz-Shawmut T084013T fast-blow fuse, 8 A FA 250 V, breaking capacity 30 kA.

2.2 - U/F Fonction and LAM

The threshold position (50 Hz - 60 Hz) to action the U/F fonction as well as the LAM setting type is selected using the potentionmeter.



WARNING: The jumper settings must correspond to the rated operating frequency (see the nameplate on the alternator).
Risk of destruction for the alternator.

The threshhold position and LAM fonction settings are done with the jumper.

Operating at 50 Hz: (U/F gradient)

0: threshold at 48 Hz without LAM for impacts between 30 and 40% of the rated load.

1: threshold at 48 Hz with LAM 13% for impacts between 40 and 70% of the rated load.

2: threshold at 48 Hz with LAM 25% for impacts > 70% of the rated load.

Operating at 60 Hz: (U/F gradient)

3: threshold at 58 Hz without LAM for impacts between 30 and 40% of the rated load.

4: threshold at 58Hz with LAM 13% for impacts 40 and 70% of the rated load.

5: threshold at 58Hz with LAM 25% for impacts > 70% of the rated load.

Specific operating

6: threshold at 57Hz without LAM for speed variations at a steady state > 2 Hz

7: threshold at 65Hz without LAM for variable speed and tractelec / gearlec (U/F gradient).

8: special: the factory setting 48Hz 2U/F gradient ; a special programme is possible on request. This programme must be specified before ordering, during the project study.

9: threshold at 47.5 Hz without LAM for speed variations at a steady state > 2 Hz.
For hydraulic applications, it is advisable to select:
- position 0 for 50 Hz
- position 3 for 60 Hz

2.3 - R250 A.V.R. option

Potentiometer for voltage setting, 1000 W / 0,5 W min: setting range ± 5 %.
- Remove the **ST4** jumper.

For wiring up the external potentiometer; the "earth" wires must be isolated as well as the potentiometer terminals (wires at the same voltage as the power).

2.4 - LAM characteristics (Load Acceptance Module)

2.4.1 - Voltage drop

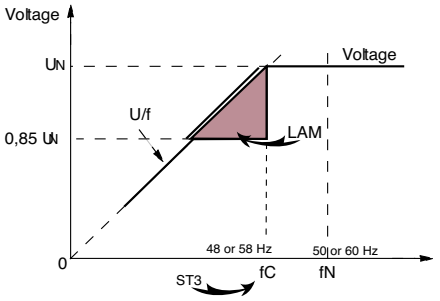
The LAM system is integrated in the A.V.R. It is active as standard. It can be adjusted to 13% or 25%.

- Role of the «LAM» (Load Adjustment Module):

On application of a load, the rotation speed of the generator set decreases. When it passes below the preset frequency threshold, the LAM causes the voltage to drop by approximately 13% or 25% and consequently the amount of active load applied is reduced by approximately 25% to 50%, until the speed reaches its rated value again.

Hence the "LAM" can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engines).
To avoid voltage oscillations, the trip threshold for the "LAM" function should be set approximately 2 Hz below the lowest frequency in steady state.

It is advised to use the "LAM" at 25% for load impacts > at 70% of the genset rated power.

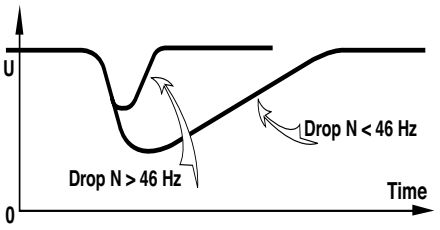


2.4.2 - Gradual voltage return function

During load impacts, the function helps the genset to return to its rated speed faster thanks to a gradual increase in voltage according to the following principles:

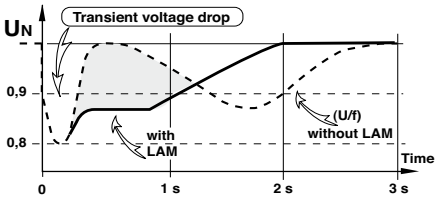
- if the speed drops between 46 Hz and 50 Hz, the rated voltage follows a fast gradient as it is restored.

- if the speed drops below 46 Hz, since the engine needs more help, the voltage follows a slow gradient as it returns to the reference value.

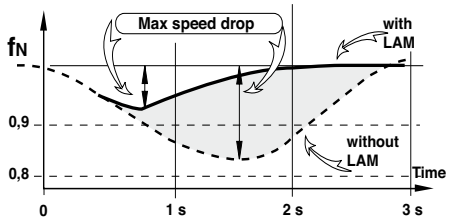


2.5 - Typical effects of the LAM with a diesel engine or without a LAM (U/F only)

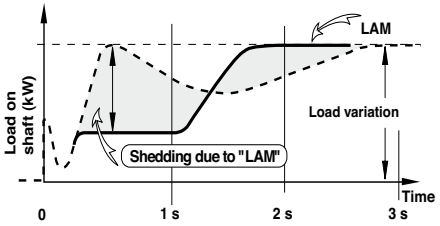
2.5.1 - Voltage



2.5.2 - Frequency



2.5.3 - Power



3 - INSTALLATION - COMMISSIONING

3.1 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached wiring diagram.

- Check that the position of the jumper corresponds to the operating frequency.

- Check whether the ST4 jumper or the remote adjustment potentiometer have been connected.

3.2 - Settings

The different settings made during the trial are to be done by qualified personnel. Respecting the load speed specified on the nameplate is vital in order to start a settings procedure. After operational testing, replace all access panels or covers.
The only possible settings on the machine are to be done with the A.V.R.

3.2.1 - R250 settings (SHUNT system)

Initial potentiometer positions

- voltage setting potentiometer **P1** for the A.V.R.: full left

- remote voltage setting potentiometer: in the middle.

Operate the alternator at its rated speed: if the voltage does not rise it is necessary to re-magnatise the magnetic circuit.

- slowly adjust the voltage potentiometer of the A.V.R. **P1** until the output voltage reaches its rated value.

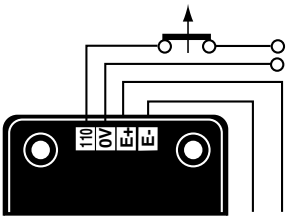
- Stability setting with **P2**.

3.2.2 - Special type of use

WARNING

Excitation circuit E+, E- must not be left open when the machine is running: A.V.R. damage will occur.

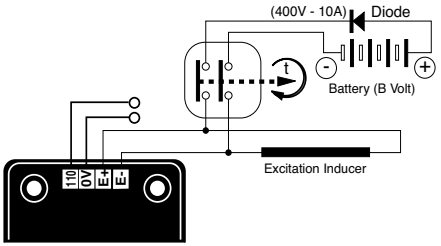
3.2.2.1 - R250 field weakening (SHUNT)



The exciter is switched off by disconnecting the A.V.R. power supply (1 wire - 0 or 110V).
Contact rating: 16A - 250V AC

Do not reclose the power supply until the voltage has reached a value ≤15% of the rated voltage (approximately 5 seconds after opening)

3.2.2.2 - R250 field forcing



The battery must be isolated from the mass.

Exciter field may be at line potential.

3.3 - Electrical faults

Fault	Action	Effect	Check/cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 volts to terminals E- and E+ respecting the polarity for 2 to 3 seconds	The alternator starts up and its voltage is still correct when the battery is removed.	- Lack of residual magnetism
		The alternator starts up but its voltage does not reach the rated value when the battery is removed.	- Check the connection of the voltage reference to the A.V.R. - Faulty diodes - Induced short circuit
		The alternator starts up but its voltage disappears when the battery is removed	- Faulty A.V.R. - Exciter field short-circuited - Short-circuit in the main field. Check the resistance
Voltage too low	Check the drive speed	Correct speed	Check the A.V.R. connections (A.V.R. may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Main field winding short-circuited - Check the resistance
		Speed too low	Increase the drive speed (Do not touch the A.V.R. pot (P1) before returning to the correct speed.)
Voltage too high	Adjust A.V.R. potentiometer	Adjustment ineffective	- Faulty A.V.R. - 1 faulty diode
Voltage oscillations	Adjust A.V.R. stability potentiometer		- Check the speed: possibility of cyclic irregularity - Loose terminals - Faulty A.V.R. - Speed too low on load (or U/F gradient set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between E+ and E- on the A.V.R.		- Check the speed (or U/F gradient set too high)
			- Faulty rotating diodes - Short-circuit in the main field. Check the resistance - Faulty induced excitaion
(*) Warning: For single-phase operation, check that the sensing wires coming from the A.V.R. are correctly connected to the operating terminals (see the alternator manual).			
Voltage disappears during operation	Check the A.V.R., the surge suppressor, the rotating diodes and replace any defective components	The voltage does not return to the rated value	- Exciter winding open circuit - Faulty induced excitation - Faulty A.V.R. - Main field open circuit or short-circuited

Warning: after setting-up or trouble-shooting, replace all access panels or covers.

4 - SPARE PARTS

4.1 - Designation

Description	Type	Code
A.V.R.	R 250	AEM 110 RE 019

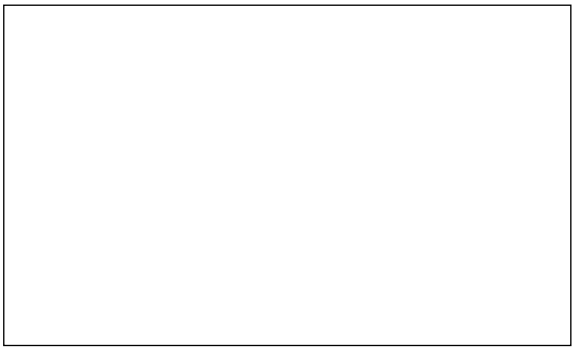
4.2 - Technical support service

Our technical support service will be pleased to help you with any information needed.

For replacement part orders, it is necessary to indicate the type and the code number of the A.V.R.

Please contact your usual correspondant.

An extensive network of service centres is available to rapidly supply any necessary parts.
In order to ensure the correct operation and safety of our machines, we strongly recommend that original manufacturer's spare parts are used.
Failure to do so, will discharge the manufacturer from liabilty in the case of damage.



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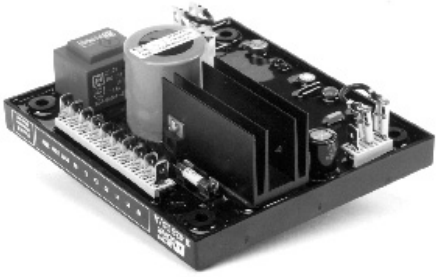
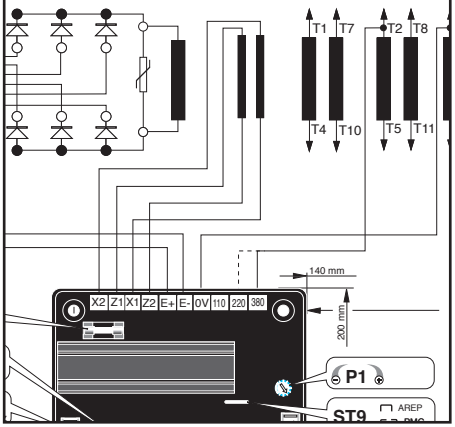


This manual is to be given to the end user



R438

A.V.R.

Installation and maintenance

259/290

R438
A.V.R.

This manual concerns the alternator A.V.R. which you have just purchased.

We wish to draw your attention to the contents of this maintenance manual. By following certain important points during installation, use and servicing of your A.V.R., you can look forward to many years of trouble-free operation.

SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional infor-mation you may require.

The various operations described in this manual are accompanied by recommen-dations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

This A.V.R. can be incorporated in a machine marked C.E.

WARNING

Warning symbol for an operation capable of damaging or destroying the machine or surround-ing equipment.

Warning symbol for general danger to personnel.

Warning symbol for electrical danger to personnel.

Note: LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

R438
A.V.R.

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All such operations performed on the A.V.R. should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components.

The R438 is an IP00 product. It must be installed inside a unit so that this unit's cover can provide IP20 minimum total protection (it must only be installed on LS alternators in the appropriate location so that when viewed externally, it has a higher degree of protection than IP20).

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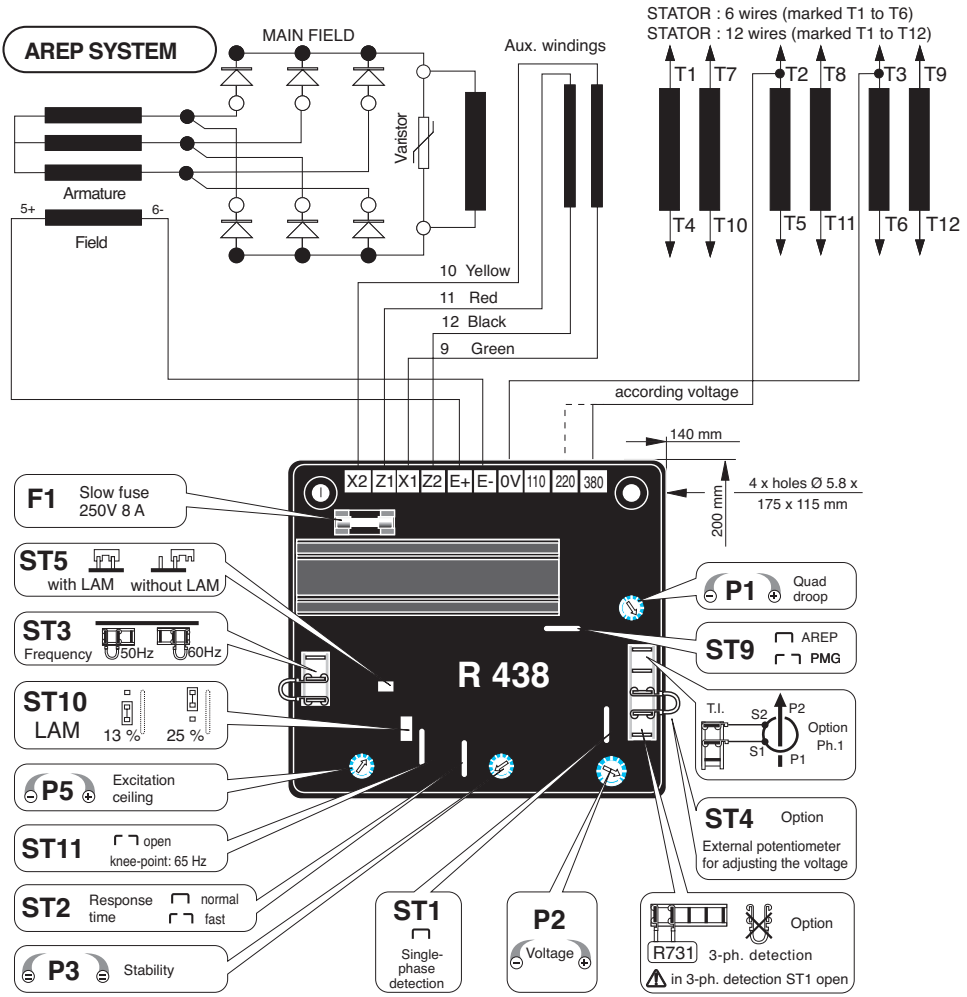
R438
A.V.R.

1 - SUPPLY

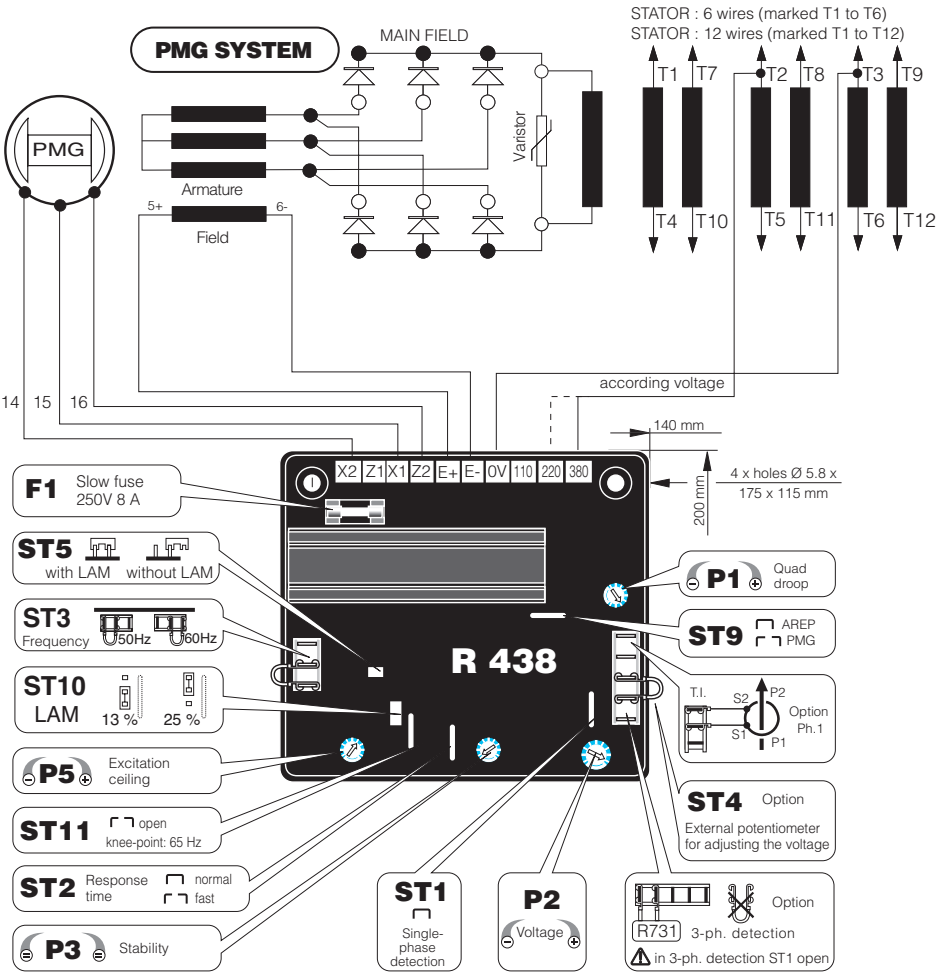
1.1 - AREP excitation system

For both AREP & PMG excitation systems, the alternator voltage regulator is the R438. With **AREP** excitation, the R438 electronic AVR is powered by two auxiliary windings which are independent of the voltage match circuit.
The first winding has a voltage in proportion to that of the alternator (characteristic Shunt), the second has a voltage in proportion to the stator current (compound characteristic: Booster effect).
The power supply voltage is rectified and filtered before being used by the AVR monitoring transistor. This principle ensures that regulation is not affected by distortions generated by the load.



1.2 - PMG excitation system

This excitation system consists of a «**PMG**» (permanent magnet generator). This is fitted at the rear of the machine and connected to the R438 AVR.
The PMG supplies the AVR with constant voltage which is independent of the main alternator winding. As a result the machine has a short-circuit current capacity and good immunity to distortions generated by the load.
The AVR monitors and corrects the alternator output voltage by adjusting the excitation current.
- 50/60 Hz selection via the **ST3** jumper.



1.3 - SHUNT or separate excitation system

A.V.R. can be operated with SHUNT supply (with a transformer / secondary 50V or a 48V battery).

2 - R438 A.V.R.

2.1 - Characteristics

- Storage : -55°C ; +85°C
- Operation : -40°C ; +70°C
- Standard power supply: AREP or PMG.
- Rated overload current: 8 A - 10 s
- Electronic protection (overload, short-circuit on opening of voltage sensing circuit): excitation overload current for 10 seconds then return to approximately 1A. The alternator must be stopped (or the power switched off) in order to reset the protection.
- Fuse : F1 on X1, X2. 8A ; slow - 250V
- Voltage sensing : 5 VA isolated via transformer ;
  - 0-110 V terminals = 95 to 140 V,
  - 0-220 V terminals = 170 to 260 V,
  - 0-380 V terminals = 340 to 520 V.
- Voltage regulation ± 1%.
- Normal or rapid response time via **ST2** jumper (see below).
- Voltage adjustment via potentiometer **P2**. other voltages via adapter transformer
- Current sensing (parallel operation): C.T. 2.5 VA cl1, secondary 1 A (optional).
- Quadrature droop adjustment via potentiometer **P1**.
- Max. excitation current adjustment via **P5** (see below).

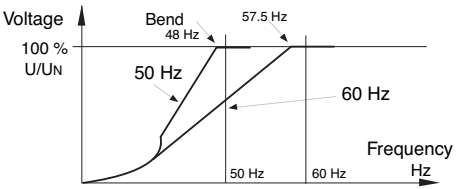
2.1.1 - Configuration jumpers function

Pot.	Delivrery config.		Position	Function
	Open	Closed		
ST1	3-ph.	Mono		Open for module installation tri detection
ST2	Fast	Normal		Response time
ST3			50 ou 60 Hz	Frequency selection
ST4	External potentio-meter	Without		Potentiometer
ST5	Without	With		LAM
ST9	Others (PMG...)	AREP		Supply
ST10			13% or 25%	LAM voltage drop amplitude
ST11	65 Hz	48 or 58 Hz		U/f function bend position

2.1.2 - Setting potentiometers function

Delivrery position	Pot.	Function
0	P1	Quadrature droop ; // operation with C.T.
400V	P2	Voltage
Centre	P3	Stability
Maxi	P5	Excitation current ceiling

2.2 - Frequency compared with voltage (without LAM)

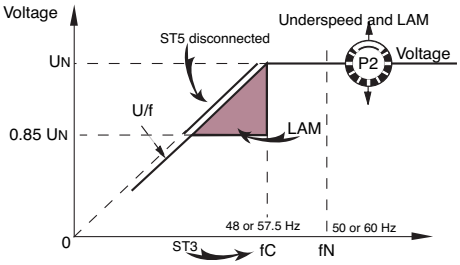


2.3 - LAM (Load Acceptance Module) characteristics

2.3.1 - Voltage drop

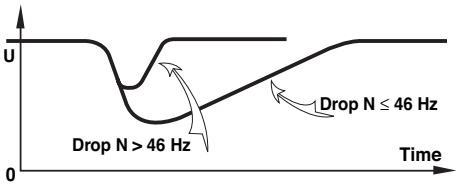
The LAM system is integrated in the R 438 AVR as standard.
Role of the «LAM» (Load Adjustment Module) :
On application of a load, the rotation speed of the generator set decreases. When it passes below the preset frequency threshold, the LAM causes the voltage to drop by approximately 13% or 25% and consequently the amount of active load applied is reduced by approximately 25% to 50%, until the speed reaches its rated value again.
Hence the LAM can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engine).
To avoid voltage oscillations, the trip threshold for the LAM function should be set approximately 2 Hz below the lowest frequency in steady state.

- LAM : action eliminated by cutting the ST5 jumper.



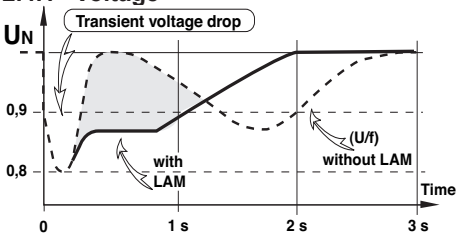
2.3.2 - Gradual voltage return function

During load impacts, the function helps the genset to return to its rated speed faster thanks to a gradual increase in voltage according to the principle:
- If the speed drops between 46 and 50 Hz, the rated voltage follows a fast gradient as it is restored.
- If the speed drops below 46 Hz, since the engine needs more help, the voltage follows a slow gradient as it returns to the reference value.

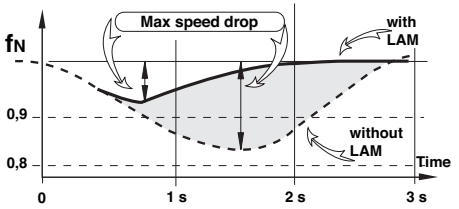


2.4 - Typical effects of the LAM with a diesel engine with or without a LAM (U/F only)

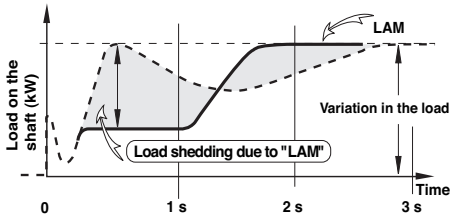
2.4.1 - Voltage



2.4.2 - Frequency



2.4.3 - Power



2.5 - R438 A.V.R. options

- **Current transformer** for parallel operation of ...../1A. 5 VA CL 1.

- **Remote voltage adjustment potentiometer**: 470 Ω, 0.5 W min: adjustment range ± 5% (range limited by internal voltage potentiometer **P2**). Remove ST4 to connect the poten-tiometer. (A 1 kΩ potentiometer can also be used to extend the adjustment range).

For wiring up the external potentiometer; the "earth" wires must be isolated as well as the potentiometer terminals (wires at the same voltage as the power).

- **R 731 external module**: sensing of 3-phase voltage 200 to 500 V, compatible with parallel operation. Disconnect ST1 to connect the module; set the voltage via the module potentiometer.

- **R 734 module**: detection of 3-phase current and voltage for parallel operation on unbalanced installations (imbalance > 15%).

- **R 726 module**: 3 functions (mounted externally).
P.F. regulation (2F) and voltage sensing circuit before paralleling (3 F).

- **Control through DC voltage** used monitoring apply to the terminals for connection of a potentiometer DC voltage :
• internal impedance 1,5 kΩ
• ± 0,5V enable a voltage setting of 10%.

3 - INSTALLATION - COMMISSIONING

3.1 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached wiring diagram.
- Check that the ST3 frequency selection jumper is on the correct frequency setting.
- Check whether the ST4 jumper or the remote adjustment potentiometer have been connected.
- Optional operating modes.
  • ST1 jumper : open to connect the R 731or R 734 3-phase sensing module.
  • ST2 jumper : open if rapid response time used
  • ST5 jumper : open to suppress the LAM function.

3.2 - Settings

The machine is tested and set at the factory. When first used with no load, make sure that the drive speed is correct and stable (see the nameplate). After operational testing, replace all access panels or covers.
The only possible adjustments to the machine should be made on the AVR.

3.2.1 - R438 settings (AREP or PMG system)

WARNING

Before any intervention on the A.V.R., make sure that the ST9 jumper is closed with AREP excitation and disconnected with PMG or SHUNT or separate excitation.

a) Initial potentiometer settings (see table below)
- Remote voltage adjustment potentiometer : centre (ST4 jumper removed).

Action	Factory setting	Pot.
Voltage minimum fully anti-clockwise	400V - 50 Hz (Input 0 - 380 V)	
Stability	Not set (centre position)	
Voltage quadrature droop (// operation with C.T.) - 0 quadrature loop fully anti-clockwise.	Not set (fully anti-clockwise)	
Excitation ceiling Limit of excitation and short-circuit current, minimum fully anti-clockwise.	10 A maximum	

Stability adjustments in standalone operation

b) Install a D.C. analogue voltmeter (needle dial) cal. 50V on terminals E+, E- and an A.C. voltmeter cal 300 - 500 or 1000V on the alternator output terminals.

c) Make sure that the **ST3** jumper is positioned on the desired frequency (50 or 60 Hz).

d) Voltage potentiometer **P2** at minimum, fully anti-clockwise.

e) Stability potentiometer **P3** to around 1/3 of the anti-clockwise limit.

f) Start the engine and set its speed to a frequency of 48 Hz for 50 Hz, or 58 for 60 Hz.

g) Set the output voltage to the desired value using **P2**.
- Rated voltage UN for solo operation (eg. 400 V)
- Or UN + 2 to 4% for parallel operation with C.T. (eg. 410 V)
If the voltage oscillates, use P3 to make adjustments (try both directions) observing the voltage between E+ and E- (approx. 10V D.C.).

The best response times are obtained at the limit of the instability. If no stable position can be obtained, try disconnecting or replacing the ST2 jumper (normal/fast).

h) Check LAM operation : **ST5** closed.

i) Vary the frequency (speed) around 48 or 58 Hz according to the operating frequency, and check the change in voltage from that observed previously (~ 15%).

j) Readjust the speed of the unit to its rated no-load value.
Adjustments in parallel operation

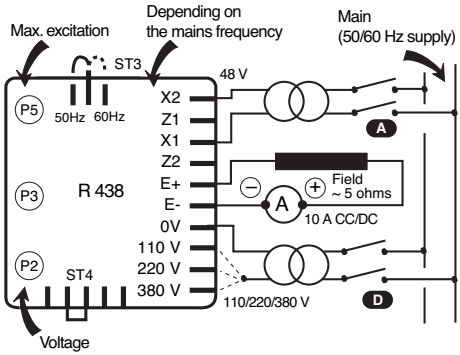
Before any intervention on the alternator, make sure that the speed droop is identical for all engines.

k) Preset for parallel operation (with C.T. connected to S1, S2)
- Potentiometer P1 (quadrature droop) in centre position.
Apply the rated load (cos φ = 0.8 inductive). The voltage should drop by 2 to 3%. If it increases, check that V and W and also S1 and S2 have not been reversed.

l) The no-load voltages should be identical for all the alternators intended to run in parallel.
- Couple the machines in parallel.
- By adjusting the **speed**, try to obtain **0 KW** power exchange.
- By altering the voltage setting P2 on one of the machines, try to cancel (or minimise) **the current** circulating between the machines.
- From now on, do not touch the voltage settings.

m) Apply the available load (the setting is only correct if a **reactive** load is available)
- By altering the **speed**, match the **kW** (or divide the rated power of the units proportionally)
- By altering the quadrature droop potentiometer **P1**, match or divide the **currents**.

3.2.2 - Max. excitation setting (excitation ceiling)



Static adjustment of the current limit, potentiometer P5 (factory setting: 7.5 A, fuse rating: 8 A - 10 seconds).

The maximum factory setting corresponds to that of the excitation current required to obtain a 3-phase short-circuit current of approximately 3 IN at 50 Hz for industrial power, unless otherwise specified(*).

A static method can be used to reduce this value or adapt the Isc to the actual operating power (derated machine), which is safer for the alternator and the installation. Disconnect power supply wires X1,X2 and Z1,Z2 and the voltage reference (0-110V-220V-380V) on the alternator.

Connect the mains power supply using a transformer (200-240V) as indicated (X1,X2 : 48V). Install a 10A D.C. ammeter in series with the exciter field. Turn P5 fully anti-clockwise and activate the power supply. If there is no output current from the AVR, turn potentiometer P2 (voltage) clockwise until the ammeter indicates a stable current. Switch the power supply off, then on again, turn P5 clockwise until the required max. current is obtained (no more than 8 A).

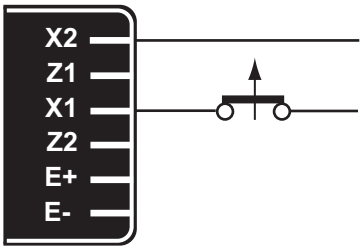
Checking the internal protection :
Open switch (D) : the excitation current should increase to its preset ceiling, remain at that level for ≥ 10 seconds and then drop to < 1A.
To reset, switch off the power supply by opening switch (A).
Note: After setting the excitation ceiling as described, adjust the voltage again (see section 2.1.1)
(*) In some countries it is a legal requirement to have a short-circuit current of 3 I_N, so as to offer selective protection.

3.2.3 - Special type of use

WARNING

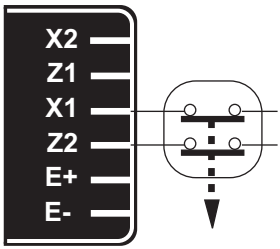
Excitation circuit E+, E- must not be left open when the machine is running : AVR damage will occur.

3.2.3.1 - R438 field weakening (SHUNT)



The exciter is switched off by disconnecting the AVR power supply (1 wire - X1 or X2).
Contact rating 16 A - 250V A.C.

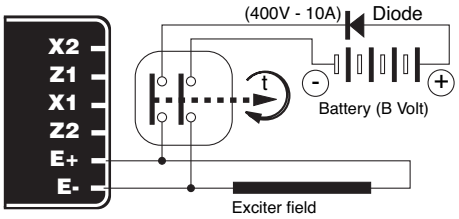
3.2.3.2 - R438 field weakening (AREP/ PMG)

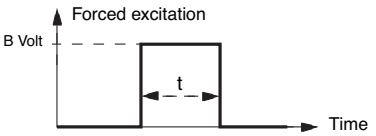


The exciter is switched off by disconnecting the AVR power supply (1 wire on each auxiliary winding) - contact rating 16 A - 250V A.C.
Connection is identical for resetting the AVR internal protection.

In case of using the de-excitation, provide a forced excitation.

3.2.3.3 - R438 field forcing





Applications	B volts	Time t
Guaranteed voltage build-up	12 (1A)	1 - 2 s
Parallel operation, de-energized	12 (1A)	1 - 2 s
Parallel operation, at standstill	12 (1A)	5 - 10 s
Frequency starting	12 (1A)	5 - 10 s
Sustained voltage on overload	12 (1A)	5 - 10 s

3.3 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 volts to terminals E- and E+, respecting the polarity, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed.	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed.	- Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings disconnected - Main field winding open circuit - check the resistance
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Main field winding short-circuited - Check the resistance
		Speed too low	Increase the drive speed (Do not touch the AVR voltage pot. (P2) before running at the correct speed.)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	Faulty AVR
Voltage oscillations	Adjust AVR stability potentiometer	If no effect : try normal / fast recovery modes (ST2)	- Check the speed : possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or U/F bend set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between E+ and E- on the AVR	Voltage between E+ and E- SHUNT < 20 V AREP / PMG < 10V	- Check the speed (or U/F bend set too high)
		Voltage between E+ and E- SHUNT > 30V AREP / PMG > 15V	- Faulty rotating diodes - Short-circuit in the main field. Check the resistance - Faulty exciter armature.
(*) Caution : For single-phase operation, check that the sensing wires coming from the AVR are correctly connected to the operating terminals			
Voltage disappears during operation (**)	Check the AVR, the surge suppressor, the rotating diodes, and replace any defective components	The voltage does not return to the rated value.	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Main field open circuit or short-circuited
(**) Caution : Internal protection may be activated (overload, open circuit, short-circuit)			

Warning : after operational testing, replace all access panels or covers.

4 - SPARE PARTS

4.1 - Designation

Description	Type	Code
A.V.R.	R 438	AEM 110 RE 017

4.2 - Technical support service

Our technical support service will be happy to provide any information you require.

When ordering spare parts, you should indicate the complete machine type, its serial number and the information indicated on the nameplate.

Part numbers should be identified from the exploded views and their description in the parts list.

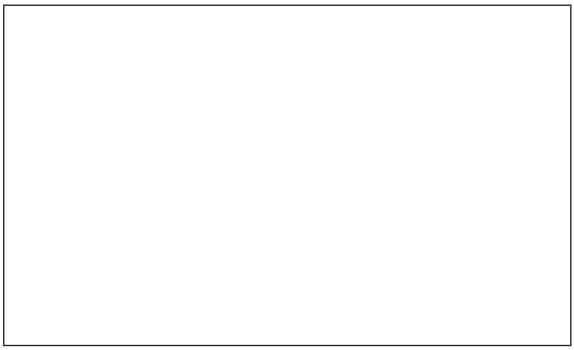
Our extensive network of «service stations» can dispatch the necessary parts without delay.
To ensure correct operation and the safety of our machines, we recommend the use of original manufacture spare parts.
In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

R438

NOTES

R438

NOTES



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10.3. Appendix C - List of John Deere - Volvo and Perkins fault codes

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
28									**Throttle #3 Position**	
					3	■			Throttle Voltage high, short to V+	Short to V+
					4	■			Throttle Voltage low, short to V-	Short to V-
29									**Throttle #2 Position**	
					3	■			Throttle Voltage high, short to V+	Short to V+
					4	■			Throttle Voltage low, short to V-	Short to V-
					14	■			Throttle voltage out of range	
84									**Vehicle speed**	
					2	■			Vehicle invalid or missing	Not possible with Genset application
					31	■			Vehicle speed mismatch	
91	**91**		**91**	**132**			■		**Accelerator pedal position**	**FMI not determined for all VOLVO's**
					3	■			Throttle Voltage high, short to V+	Not possible with genset application, codes declared by the CAN J1587 for VOLVO.
					4	■			Throttle Voltage low, short to V-	
					7	■			Throttle calibration invalid	
					8	■		■	PWM throttle abnormal pulse width	
					9	■			Throttle invalid (CAN value)	
					10	■			Throttle voltage out of range low	
					13	■			Throttle calibration aborted	
					14	■			Throttle voltage out of range	
94			**94**				■		**Fuel rail pressure sensor**	
					1	■	■		Fuel supply pressure extremely low	
					3	■	■		Fuel rail pressure input voltage high	Short to V+
					4	■			Fuel rail pressure input voltage low	Short to V-
					5		■		Fuel rail pressure sensor open circuit	
					10	■			Fuel rail pressure lost detected	
					13	■			Fuel rail pressure higher than expected	
					16	■			Fuel supply pressure moderately high	
					17	■			Fuel rail pressure not developed	
					18	■			Fuel supply pressure moderately low	
97			**97**				■		**Water in fuel sensor**	
					0	■	■		Water in fuel continuously detected	
					3	■	■		Water in fuel input voltage high	Short to V+
					4	■			Water in fuel input voltage low	Short to V-
					16	■			Water in fuel detected	
					31	■			Water in fuel detected	
98			**98**				■		**Oil level sensor**	
					1		■		Oil level value below normal	
					3		■		Oil level sensor input voltage high	Short to V+
					4		■		Oil level sensor input voltage low	Short to V-
					5		■		Oil level sensor open circuit	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
100	**100**		**100**				■		**Oil pressure sensor**	
					1	■	■		Engine oil pressure extremely low	
					3	■	■	■	Oil pressure sensor input voltage high	Short to V+
					4	■		■	Oil pressure sensor input voltage low	Short to V-
					5		■		Oil pressure sensor open circuit	
					17			■	Engine oil pressure low	
					18	■		■	Engine oil pressure moderately low	
					31	■			Oil pressure detected, motor stopped	
102	**273**		**102**				■		**Manifold air pressure sensor**	
					0		■		Manifold air pressure above normal	
					1		■		Manifold air pressure below normal	
					2	■			Incoherent measurement of the oil pressure	
					3	■	■	■	Manifold air pressure sensor input voltage high	Short to V+
					4	■	■	■	Manifold air pressure sensor input voltage low	Short to V-
					15			■	Manifold air pressure moderately low	
					16			■	Manifold air pressure low	
103									**Turbo speed sensor**	
					0	■			Turbo speed too high	
					5	■			Turbo speed sensor circuit open	
					6	■			Sensor shorted to earth	Short to V-
					8	■			Speed signal invalid	
					31	■			Intermittent problem with speed information	
105			**105**				■		**Manifold air temperature sensor**	
					0	■	■		Manifold air temperature extremely high	
					3	■			Manifold air temperature sensor input voltage high	
					4	■	■		Manifold air temperature sensor input voltage low	
					5		■		Manifold air temperature sensor open circuit	
					15	■			Air temperature very high.	
					16	■			Manifold air temperature moderately high	
106			**106**				■		**Air inlet pressure sensor**	
					0		■		Air inlet pressure above normal	
					3		■		Air inlet pressure sensor input voltage high	
					5		■		Air inlet pressure sensor open circuit	

SPN			PID		FMI	John Deere	Volvo	Perkins	Description	Comment
107			**107**				■		**Air filter differential pressure sensor**	
					0	■	■		Air filter restriction high	
					3		■		Air filter differential pressure sensor input voltage high	
					4		■		Air filter differential pressure sensor input voltage low	
					5		■		Air filter differential pressure sensor open circuit	
					31	■			Air filter restriction high	
108	**274**		**108**				■		**Barometric pressure sensor**	**Not use with EDC III and EMS2**
					2	■			Air pressure invalid	
					3			■	High barometric pressure sensor short to high	
					4			■	High barometric pressure sensor short to low	
					17			■	High barometric pressure	ECM option, sensor not connected
110	**110**		**110**				■		**Coolant temperature sensor**	
					0	■	■	■	Coolant temperature extremely high	
					3	■	■	■	Coolant temperature sensor input voltage high	
					4	■	■	■	Coolant temperature sensor input voltage low	
					5		■		Coolant temperature sensor open circuit	
					15	■		■	Coolant temperature high least severe	
					16	■		■	Coolant temperature moderately high	
					17	■			Water temperature very low	
					31	■			Coolant temperature high	
111			**111**						**Coolant level sensor**	
					0		■		Engine coolant level low	
					1	■			Engine coolant level low	
					3	■	■		Coolant level sensor input voltage high	
					4	■			Coolant level sensor input voltage low	
153			**153**						**Crankcase pressure sensor**	
					0		■		Value above normal	
					3		■		Crankcase pressure sensor input voltage high	
					5		■		Crankcase pressure sensor open circuit	
157									**Fuel pressure sensor in the common rail**	
					1	■			Fuel pressure too low	
					3	■			Input voltage of the pressure sensor high	Short to V+
					4	■			Input voltage of the pressure sensor low	Short to V-
					10	■			Loss of fuel pressure detected	
					16	■			Fuel pressure moderately high	
					17	■			Fuel ramp pressure not reached	
					18	■			Oil pressure moderately low	

SPN			PID		FMI	John Deere	Volvo	Perkins	Description	Comment
158			**158**						**Battery voltage sensor**	
					1		■		Voltage above normal	
					17	■			ECU power down error	
160									**Wheel speed sensor**	
					2	■			Wheel speed input noise	
164		**164**							**Injection pressure control**	
168	**168**								**Electrical system voltage**	
					2			■	Electrical system voltage low	
172	**172**		**172**						**Ambient air temperature sensor**	**Inlet air temperature sensor for PERKINS**
					3			■	Ambient air temperature sensor input voltage high	Inlet air temperature sensor input voltage high
					4		■	■	Ambient air temperature sensor input voltage low	Inlet air temperature sensor input voltage low
					5		■		Ambient air temperature sensor open circuit	
					15			■		High Inlet air temperature alarm-warning
					16			■		High Inlet air temperature alarm-action alert
174	**174**								**Fuel temperature sensor**	
					0	■			Fuel temperature high most severe	
					3	■		■	Fuel temperature sensor input voltage high	
					4	■		■	Fuel temperature sensor input voltage low	
					15	■		■	Fuel temperature high	
					16	■		■	Fuel temperature moderately high	
					31	■			Fuel temperature sensor faulty	
175			**175**						**Oil temperature sensor**	
					0		■		Oil temperature extremely high	
					3		■		Oil temperature sensor input voltage high	
					4		■		Oil temperature sensor input voltage low	
					5		■		Oil temperature sensor open circuit	
177									**Transmission oil temperature sensor**	
					9	■			Transmission oil temperature invalid	Not possible with Genset application
189									**Rated engine speed**	
					0	■			Engine speed de rated	
					31	■			Engine speed de rated	
190	**190**		**190**				■		**Engine speed sensor**	
					0	■		■	Overspeed extreme	
					2			■	Engine speed sensor data intermittent	
					9			■	Engine speed sensor abnormal update	
					11			■	Engine speed sensor signal lost	
					12			■	Engine speed sensor signal lost	
					15			■	Overspeed	
					16	■		■	Overspeed moderate	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
228	**261**								**Speed sensor calibration**	
					13			■	Engine timing abnormal calibration	
252	**252**								**Software**	
					11			■	Incorrect engine software	
234	**253**								**Check system parameters**	
					2			■	Incorrect parameters	
281	**281**								**Action alert output status**	
					3			■	Action alert output open/short to B+	
					4			■	Action alert output short to ground	
					5			■	Action alert output open circuit	
282	**282**								**Overspeed output status**	
					3			■	Overspeed output open/short to B+	
					4			■	Overspeed output short to ground	
285	**285**								**Coolant temperature output status**	
					3			■	Coolant temperature lamp open/short to B+	
					4			■	Coolant temperature lamp short to ground	
286	**286**								**Oil pressure output status**	
					3			■	Oil pressure output open/short to B+	
					4			■	Oil pressure output short to ground	
					5			■	Oil pressure output open circuit	
323	**323**								**Shutdown output status**	
					3			■	Shutdown output open/short to B+	
					4			■	Shutdown output short to ground	
					5			■	Shutdown output open circuit	
324	**324**								**Warning output status**	
					3			■	Warning output open/short to B+	
					4			■	Warning output short to ground	
					5			■	Warning output open circuit	
412									**Temperature sensor in the EGR valve.**	
					0	■			Temperature in the EGR extremely high	
					3	■			Input voltage of the temperature sensor high	Short to V+
					4	■			Input voltage of the temperature sensor low	Short to V-
					15	■			Temperature in the EGR high	
					16	■			Temperature in the EGR moderately high	
443	**443**								**ENGINE RUN output status**	
					3			■	Engine run output open/short to B+	
					4			■	Engine run output short to B-	
523									**Gear selection**	
					9	■			Gear selection invalid	Not possible with Genset application

SPN		SID			FMI	John Deere	Volvo	Perkins	Description	Comment
608		**250**				■			**Data link faulty J1587 Start/Stop redundancy / J1939 communication bus**	
608				**132**		■			**Redundancy of the accelerator**	
608				**98**		■			**Redundancy of the Stop/start information**	
611									**Injector wiring status**	
					3	■			Injector wiring shorted to power source	
					4	■			Injector wiring shorted to ground	
620	**262**	**232**					■		**5 Volt sensor power supply**	**FMI not informed by VOLVO**
					3	■		■	Sensor power supply open/short to B+	
					4	■		■	Sensor power supply short to ground	
626			**45**				■		**Start enable device (intake heater and ether)**	
					3		■		Start enable device output short to B+	Not used, the control panel is in charge of managing the start enable device
					4		■		Start enable device output short to ground	
					5		■		Start enable device output open circuit	
627									**Power supply**	
					1	■			Injector supply voltage problem	For 6125HF070 only
					4	■			ECU unswitched power missing	For 6068HF275 VP44 only
					18	■			Battery voltage below the operating voltage	For John DEERE Tiers III
628		**240**					■		**Memory fault in EMS2**	
629		**254**					■		**ECU status/controller error**	**CIU module status**
					2		■		RAM cell test failure	
					8		■		CPU watchdog reset test failure	
					11		■		Main and fuelling ASIC test fail	
					12	■	■		RAM address test failure	
					13	■	■		Watchdog trip failure	
					19	■			ECU to injection pump communication error	Possible only with 6068HF475 VP44
630		**253**					■		**Data set memory EEPROM**	
632									**Injection status**	
					2	■			Fuel shutoff error	
					5	■			Fuel shutoff non-functional	
636		**21**							**Pump position sensor/Cam position sensor/Speed sensor CAM**	Pump position or CAM position in function of the type of injection
					2	■	■		Pump position sensor/cam position sensor input noise	
					3		■		Permanent loss of signal	
					5	■			High impedance of the position sensor or circuit open	
					6	■			Sensor short to ground	
					8	■	■		Pump position sensor/cam position sensor input missing	
					9		■		Not informed by VOLVO	
					10	■			Pump position sensor/cam position sensor input pattern error	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
637		**22**							**Crank position sensor/Speed sensor flywheel**	
					2	■	■		Crank position input noise	
					3		■		Permanent loss of signal	
					5	■			High impedance of the position sensor or open circuit	
					6	■			Sensor short to ground	
					7	■			Crank position/Cam position out of synchronisation	
					8	■	■		Crank position input missing	
					9		■		Not informed by VOLVO	
					10	■			Crank position sensor input pattern error	
639	**247**	**231**							**Communication status**	
					2		■		Bus Off error	
					9		■		Passive bus error	
					11		■		Data registers read back failure	
					12		■		Loss of message error	
					13	■			Bus CAN error	
640									**Engine shutdown vehicle status**	
					11	■			Engine shutdown vehicle request invalid	
					31	■			Engine shutdown vehicle request	
641									**Status of the Turbo with variable geometry**	
					4	■			Supply voltage of the Turbo actuator low	
					12	■			Error in communication between the ECU and the TGV actuator	
					13	■			Error in position of the TGV	
					16	■			Temperature of the actuator moderately high.	
647									**Fan supply**	
					3	■			Short circuit to earth	
					5	■			Open circuit	
651	**1**	**1**	**651**				■		**Cylinder #1 injector status**	
					0	■			Injector outside specifications	Recalibration of the injectors required
					1	■			Injector outside specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #1 circuit open	
					6	■			Cylinder #1 circuit shorted	
					7	■	■	■	Cylinder #1 balancing error/mechanical failure	
					11		■	■	Cylinder #1 unknown error/mechanical failure	

SPN	CID	SID	PID		FMI	John Deere	Volvo	Perkins	Description	Comment
652	**2**	**2**	**652**				■		**Cylinder #2 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #2 circuit open	
					6	■			Cylinder #2 circuit shorted	
					7	■	■		Cylinder #2 balancing error/mechanical failure	
					11		■		Cylinder #2 unknown error/mechanical failure	
653	**3**	**3**	**653**				■		**Cylinder #3 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #3 circuit open	
					6	■			Cylinder #3 circuit shorted	
					7	■	■	■	Cylinder #3 balancing error/mechanical failure	
					11		■	■	Cylinder #3 unknown error/mechanical failure	
654	**4**	**4**	**654**				■		**Cylinder #4 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #4 circuit open	
					6	■			Cylinder #4 circuit shorted	
					7	■	■	■	Cylinder #4 balancing error/mechanical failure	
					11		■	■	Cylinder #4 unknown error/mechanical failure	

SPN	CID	SID	PID		FMI	John Deere	Volvo	Perkins	Description	Comment
655	**5**	**5**	**655**				■		**Cylinder #5 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #5 circuit open	
					6	■			Cylinder #5 circuit shorted	
					7	■	■	■	Cylinder #5 balancing error/mechanical failure	
					11		■	■	Cylinder #5 unknown error/mechanical failure	
656	**6**	**6**	**656**				■		**Cylinder #6 injector status**	
					0	■			Injector outside the specifications	Recalibration of the injectors required
					1	■			Injector outside the specifications	Recalibration of the injectors required
					2		■		Short circuit high side to B+	
					3		■		Short circuit high side to low side or low side to B+	
					4		■		Short circuit high or low side to ground	
					5	■	■		Cylinder #6 circuit open	
					6	■			Cylinder #6 circuit shorted	
					7	■	■	■	Cylinder #6 balancing error/mechanical failure	
					11		■	■	Cylinder #6 unknown error/mechanical failure	
676		**39**							**Glow plug relay status**	
					3	■			Glow plug relay voltage high	
					5	■			Glow plug relay voltage low	
677		**39**		**3**					**Start relay status**	
					3		■		Start relay control short circuit to high	
					4		■		Start relay control short circuit low	
					5		■		Start relay control open circuit	
678	**41**								**8 Volt power supply**	
					3			■	ACM 8 Volt DC supply open/short to B+	
					4			■	ACM 8 Volt DC supply open/short to ground	
679		**42**				■			**Regulation sensor of the injection pressure control**	
723	**342**								**Secondary speed sensor**	
					2			■	Secondary engine speed sensor data intermittent	
					11			■	Secondary engine speed sensor loss of signal	
					12			■	Loss of signal/sensor failure	

SPN		SID			FMI	John Deere	Volvo	Perkins	Description	Comment
729		**70**							**Inlet air heater signal/Preheat detection**	
					3	■			Inlet air heater signal high	
					5	■			Inlet air heater signal low	
810									**Vehicle speed**	
					2	■			Calculated vehicle speed input noise	Not possible with Genset application
861	**861**								**Diagnostic output status**	
					3			■	Diagnostic output open/short to B+	
					4			■	Diagnostic output short to ground	
898									**CAN throttle status**	
					9	■			Speed value invalid or missing	
970				**6**					**Auxiliary engine shutdown switch status EMS**	
					2	■			Auxiliary engine shutdown switch signal invalid	Not used
					31	■			Auxiliary engine shutdown switch active	
971									**External engine de rate switch status**	
					31	■			External engine de rate switch active	Not used
1069									**Tire size status**	
					2	■			Tire size error	Not possible with Genset application
					9	■			Tire size invalid	
					31	■			Tire size error	
1075									**Feed pump of the fuel circuit**	
					5	■			High impedance at the terminals of the pump or open circuit	
					6	■			Pump coil short to ground	
					12	■			Pump defective	
1076							■		**Fuel Injection pump status**	
					0	■			Pump control valve closure too long	Injection DE10
					1	■			Pump control valve closure too short	Injection DE10
					2	■			Pump detected defect	Injection VP44
					3	■			Pump solenoid current high	Injection DE10
					5	■			Pump solenoid circuit open	Injection DE10
					6	■			Pump solenoid circuit severely shorted	Injection DE10
					7	■			Pump control valve closure not detected	Injection DE10
					10	■			Pump solenoid circuit moderately shorted	Injection DE10
					13	■			Pump current decay time invalid	Injection DE10
1077									**Fuel injection pump controller status**	
					7	■			Attempting to fuel without command	
					11	■			Pump supply voltage out of range	
					12	■			Pump self test error	
					19	■			Pump detected communication error	
					31	■			Pump initiated engine protection	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
1078									**ECU/Pump timing status**	
					7	■			ECU/Pump timing moderately out of synchronisation	
					11	■			ECU/Pump timing speed out of synchronisation	
					31	■			ECU/Pump timing extremely out of synchronisation	
1079		**232**							**Sensor supply voltage (+5 Volt)**	**Analog throttle reference**
					3	■			Sensor supply voltage high	> 5,5 Volt
					4	■			Sensor supply voltage low	< 4,44 Volt
1080		**211**							**Sensor supply voltage (Oil pressure, Coolant temp, fuel pressure)/+5V sensor supply 2**	
					3	■			Sensor supply voltage high	> 5,5 Volt
					4	■			Sensor supply voltage low	< 4,40 Volt
1109									**Engine/ECU status**	
					31	■			Engine shutdown warning	
1110									**Engine status**	
					31	■			Engine shutdown	
1111	**268**								**Check parameters**	
					2			■	Programmed parameter fault	
1136				**55**			■		**ECU Temperature**	
					0	■			ECU temperature extremely high	
					16	■			ECU temperature moderately high	
1172									**Input temperature of the TGV compressor**	
					3	■			Input voltage of the temperature sensor high	Short to V+
					4	■			Input voltage of the temperature sensor low	Short to V-
1180									**Input temperature of the TGV turbine**	
					0	■			Turbine temperature extremely high	Short to V+
					16	■			Turbine temperature moderately high	Short to V-
1184			**173**						**Exhaust gas temperature sensor**	
1239				**96**			■		**Status of the pressure system of the common rail**	
1347									**Pump control valve status**	**Pump control valve #1 status for 6081HF070**
					3	■			Pump control valve current high	
					5	■			Pump control valve error/mismatch	
					7	■			Fuel rail pressure control error	
					10	■			Pump control valve fuel flow not detected	
1348									**Pump control valve #2 status**	**Only for 6081HF070**
					5	■			Pump control valve #2 error/mismatch	
					10	■			Pump control valve #2 fuel flow not detected	

SPN			PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
1485			**1485**	**5**					**Pump power relay status**	**ECU main relay of VOLVO EMS/EDC**
					2	■			Pump power relay fault	
					3		■			ECU main relay short circuit high
1568									**Torque curve selection**	
					2	■			Torque curve selection invalid	
					4	■			Torque curve input voltage high	
					9	■			Torque curve selection missing	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
1569									**Fuel supply status**	
					31	■			Fuel de rate	
1639									**Fan speed**	
					1	■			Fan speed zero or absent	
					2	■			Fan speed signal erratic	
					16	■			Fan speed more than 300 rpm above its setpoint for at least 180s	
					18	■			Fan speed more than 300 rpm below its setpoint for at least 180s	
2000									**ECU status**	
					6	■			Vehicle ID missing	
					13	■			Security violation	
2630									**Air temperature at the air cooler outlet**	
					0	■			Air temperature extremely high	
					3	■			Sensor input voltage high	Short to V+
					4	■			Sensor input voltage low	Short to V-
					15	■			Air temperature high	
					16	■			Air temperature moderately high	
2659									**Flow level of the EGR valve**	
					2	■			Calculated EGR flow not valid	
					15	■			Calculated EGR flow rather high	
					17	■			Calculated EGR flow rather low	
2790									**Air temperature at turbo compressor outlet**	
					16	■			Temperature at compressor outlet moderately high	
2791				**19**			■		**Statuses of the EGR valve**	
					2	■			Valve position signal not valid	
					3	■			Input voltage of the position sensor high	Short to V+
					4	■			Input voltage of the position sensor low	Short to V-
					7	■			Inability of the EGR valve to reach the expected position	
					13	■			The EGR valve is out of calibration	
					31	■			Error in position of the EGR valve	

SPN	CID	SID	PID	PPID	FMI	John Deere	Volvo	Perkins	Description	Comment
2795									**Position of TGV actuator**	
					7	■			The actuator does not respond or is not in the expected position	
3509									**Common supply voltage of the sensors, output #1**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
3510									**Common supply voltage of the sensors, output #2**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
3511									**Common supply voltage of the sensors, output #3**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
3512									**Common supply voltage of the sensors, output #4**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
3513									**Common supply voltage of the sensors, output #5**	
					3	■			Supply voltage of the sensor too high	Exceeding +5 volts
						■			Supply voltage of the sensor shorted to ground	
520192				**8**			■		**Cooling status of the piston**	
520194				**4**			■		**Status of the starting request input**	
520195				**6**			■		**Stop request on CIU**	

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FMI and Description

FMI=0—DATA VALID BUT ABOVE NORMAL OPERATIONAL RANGE - MOST SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined most severe level limits for that particular measure of the real world condition (*Region e* of the signal range definition) Broadcast of data values is continued as normal. Broadcast of data values is continued as normal.

FMI=1—DATA VALID BUT BELOW NORMAL OPERATIONAL RANGE - MOST SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region e* of the signal range definition). Broadcast of data values is continued as normal.

FMI=2—DATA ERRATIC, INTERMITTENT OR INCORRECT
Erratic or intermittent data includes all measurements that change at a rate that is not considered possible in the real world condition and must be caused by improper operation of the measuring device or its connection to the module. Broadcast of data value is substituted with the “error indicator” value.
Incorrect data includes any data not received and any data that is exclusive of the situations covered by FMIs 3, 4, 5 and 6. Data may also be considered incorrect if it is inconsistent with other information collected or known about the system.

FMI=3—VOLTAGE ABOVE NORMAL, OR SHORTED TO HIGH SOURCE
a. A voltage signal, data or otherwise, is above the predefined limits that bound the range (*Region e* of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
b. Any signal external to an electronic control module whose voltage remains at a high level when the ECM commands it to low. Broadcast of data value is substituted with the “error indicator” value.

FMI=4—VOLTAGE BELOW NORMAL, OR SHORTED TO LOW SOURCE
a. A voltage signal, data or otherwise, is below the predefined limits that bound the range (Region e of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
b. Any signal external to an electronic control module whose voltage remains at a low level when the ECM commands it to high. Broadcast of data value is substituted with the “error indicator” value.

FMI=5—CURRENT BELOW NORMAL OR OPEN CIRCUIT
a. A current signal, data or otherwise, is below the predefined limits that bound the range (Region e of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
b. Any signal external to an electronic control module whose current remains off when the ECM commands it on. Broadcast of data value is substituted with the “error indicator” value.

FMI=6—CURRENT ABOVE NORMAL OR GROUNDED CIRCUIT
a. A current signal, data or otherwise, is above the predefined limits that bound the range. (*Region e* of the signal range definition). Broadcast of data value is substituted with the “error indicator” value.
b. Any signal external to an electronic control module whose current remains on when the ECM commands it off. Broadcast of data value is substituted with the “error indicator” value.

FMI=7—MECHANICAL SYSTEM NOT RESPONDING OR OUT OF ADJUSTMENT
Any fault that is detected as the result of an improper mechanical adjustment or an improper response or action of a mechanical system that, with a reasonable confidence level, is not caused by an electronic or electrical system failure. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=8—ABNORMAL FREQUENCY OR PULSE WIDTH OR PERIOD
To be considered in cases of FMI 4 and 5. Any frequency or PWM signal that is outside the predefined limits which bound the signal range for frequency or duty cycle (outside *Region b* or the signal definition). Also if the signal is an ECM output, any signal whose frequency or duty cycle is not consistent with the signal which is emitted. Broadcast of data value is substituted with the “error indicator” value.

FMI=9—ABNORMAL UPDATE RATE
Any failure that is detected when receipt of data via the data link or as input from a smart actuator or smart sensor is not at the update rate expected or required by the ECM (outside *Region c* of the signal range definition). Also any error that causes the ECM not to send information at the rate required by the system. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=10—ABNORMAL RATE OF CHANGE
Any data, exclusive of the abnormalities covered by FMI 2, that is considered valid but whose data is changing at a rate that is outside the predefined limits that bound the rate of change for a properly functioning system (outside *Region c* of the signal range definition). Broadcast of data values is continued as normal.

FMI=11—ROOT CAUSE NOT KNOWN
It has been detected that a failure has occurred in a particular subsystem but the exact nature of the fault is not known. Broadcast of data value is substituted with the "error indicator" value.

FMI=12—BAD INTELLIGENT DEVICE OR COMPONENT
Internal diagnostic procedures have determined that the failure is one which requires the replacement of the ECU, used here to mean the packaged unit that includes some microprocessor and its associated components and circuits. It can be assumed that the communications subsystem is not the part that has failed, and the manufacturer has determined that there is no serviceable component smaller than the ECU involved in the failure. Broadcast of data value is substituted with the "error indicator" value if appropriate, as there may or may not be any broadcast involved. This error is to include all internal controller trouble codes that can not be caused by connections or systems external to the controller.

FMI=13—OUT OF CALIBRATION
A failure that can be identified to be the result of not being properly calibrated. This may be the case for a subsystem which can identify that the calibration attempting to be used by the controller is out of date. Or it may be the case that the mechanical subsystem is determined to be out of calibration. This failure mode does not relate to the signal range definition as do many of the FMIs.

FMI=14—SPECIAL INSTRUCTIONS
"Special Instructions" is the FMI to be used when the on-board system can isolate the failure to a small number of choices but not to a single point of failure. When the FMI is used, there is clear necessity for the service technician to take some action to complete the specific diagnosis, and the manufacturer has provided instructions for the completion of that diagnosis. There are two cases where this will be used: 1. for emission-related diagnostics where the particular failure cannot be separated between a sensor out of range and the case where the actual value is at the edge of a diagnostic region, and 2. for the older SPN 611 to 615 where the problem is in determining which of two or more circuits (which may interact) is the one that needs repair.
SPNs 611 through 615 are defined as "System Diagnostic Codes" and are used to identify failures that cannot be tied to a specific field replaceable component. Specific subsystem fault isolation is the goal of any diagnostic system, but for various reasons this cannot always be accomplished. These SPNs allow the manufacturer some flexibility to communicate non-"specific component" diagnostic information. Since SPNs 611-615 use the standard SPN/FMI format it allows the use of standard diagnostic tools, electronic dashboards, satellite systems and other advanced devices that scan Parameter Groups containing the SPN/FMI formats. Because manufacturer defined codes are not desirable in terms of standardization, the use of these codes should only occur when diagnostic information cannot be communicated as a specific component and failure mode.
Possible reasons for using a System Diagnostic Code include:

1. Cost of specific component fault isolation is not justified, or
2. New concepts in Total Vehicle Diagnostics are being developed, or
3. New diagnostic strategies that are not component specific are being developed.

Due to the fact that SPNs 611-615 are manufacturer defined and are not component specific, FMIs 0-13 and 15-31 have little meaning. Therefore, FMI 14, "Special Instructions", is usually used. The goal is to refer the service personnel to the manufacturer's troubleshooting manual for more information on the particular diagnostic code. This failure mode does not relate to the signal range definition as do many of the FMIs. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=15—DATA VALID BUT ABOVE NORMAL OPERATING RANGE - LEAST SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region i* of the signal range definition). Broadcast of data values is continued as normal.

FMI=16—DATA VALID BUT ABOVE NORMAL OPERATING RANGE - MODERATELY SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (*Region k* of the signal range definition). Broadcast of data values is continued as normal.

FMI=17—DATA VALID BUT BELOW NORMAL OPERATING RANGE - LEAST SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined least severe level limits for that particular measure of the real world condition (*Region h* of the signal range definition). Broadcast of data values is continued as normal.

FMI=18—DATA VALID BUT BELOW NORMAL OPERATING RANGE - MODERATELY SEVERE LEVEL
The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined moderately severe level limits for that particular measure of the real world condition (*Region j* of the signal range definition). Broadcast of data values is continued as normal.

FMI=19—RECEIVED NETWORK DATA IN ERROR
Any failure that is detected when the data received via the network is found substituted with the “error indicator” value (i.e. FE16, see J1939-71). This type of failure is associated with received network data. The component used to measure the real world signal is wired directly to the module sourcing the data to the network and not to the module receiving the data via the network. The FMI is applicable to *Region f* and *g* of the signal range definition. This type of fault may or may be directly associated with the value of general broadcast information.

FMI=20-30—RESERVED FOR SAE ASSIGNMENT

FMI=31—CONDITION EXISTS
Used to indicate that the condition that is identified by the SPN exists when no more applicable FMI exists or in cases when the reported SPN name spells out the component and a non-standard failure mode. This type of fault may or may be directly associated with the value of general broadcast information. This FMI will mean “not available” when the associated SPN is also “not available” as when the remainder of the packet is filled with binary ones after all data has been transmitted.